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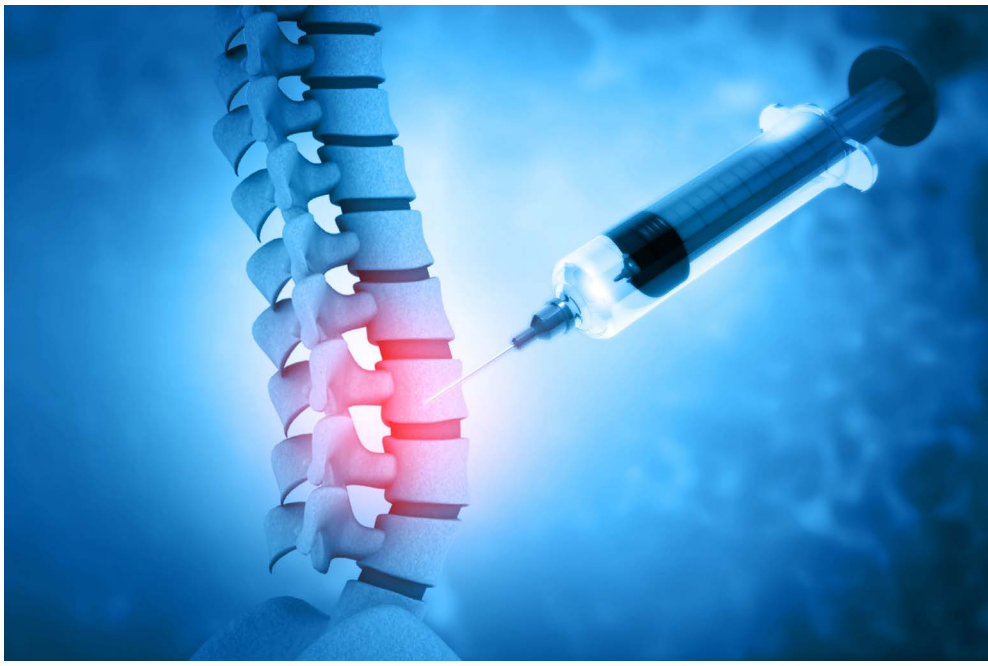
Image-guided spinal injections in the treatment of chronic spinal pain



An overview of evidence-based guideline recommendations with a specific focus on guidance techniques

Final report

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An overview of evidence-based guideline recommendations with a specific focus on guidance techniques

Vienna, November 2023

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List of abbreviations

AA.....Atlanto-axial

AGREE-II .....Appraisal of Guidelines for Research & Evaluation

ALARA .....As Low As Reasonably Achievable

ANZCA.....New Zeeland College of Anaesthetists

AO .....Atlanto-occipital

ASPN.....American Society of Pain and Neuroscience

AWMF .....German Society for Orthopedics and Orthopedic Surgery (DGOOC), Spine Section of the German Society for Orthopedics and Trauma Surgery (DGOU), German Society for Neurosurgery (DGNC) and German Spine Society (DWG)

CG .....clinical guideline

CT.....computerized tomography

ESI.....epidural steroid injection

EUnetHTA ...European network for Health Technology Assessment

FJI .....Facet joint injection

FPM .....Australia and New Zeeland, Faculty of Pain Medicine

FRI .....Federation de radiologie interventionnelle

GIRFT.....getting it right first time

GRADE.....Grading of Recommendations Assessment, Development and Evaluation

GoR .....grade of recommendation

IA.....intraarticular

ICRP .....International Commission on Radiological Protection

ILS.....Immediate Life Support

IWG (Lumbar Facet) International working group (Lumbar Facet Intervention Guidelines Committee)

IWG (Cervical Joint) International working group (Cervical Joint Working Group)

LoE.....level of evidence

LBP .....low back pain

MBA.....medial branch block

MRI.....magnetic resonance imaging

NASS.....North American Spine Society

NICE.....National Institute for Health and Care Excellence

NA .....not available

n.r. .....not reported

ORG .....organisational aspects

OSF .....Open Science Platform

PICO .....population, intervention, comparator, outcome

RFA.....radiofrequency ablation

RQ .....research question

SFR .....Societe francaise de radiologie

SIMS .....Societe d'imagerie musculosquelettique

SOC.....Patient and social aspects

SR.....systematic review

TFESI .....transforaminal epidural steroid injection

TON .....third occipital nerve

UK.....United Kingdom

USASP .....US Association for the Study of Pain

US.....United States

Glossary

This glossary uses definitions provided by the Food and Drug Administration, American Association of Neurological Surgeons, Radiopaedia, Mayfield Clinic of Cincinnati and Veritas Health (ref 1-5).

Medical imaging: refers to several different technologies used to view the human body to diagnose, monitor, or treat medical conditions. Each type of technology gives different information about the area of the body being studied or treated, related to possible disease, injury, or the effectiveness of medical treatment.

Fluoroscopy: is a type of medical imaging that shows a continuous X-ray image on a monitor, much like an X-ray movie. During a fluoroscopy procedure, an X-ray beam is passed through the body. The image is transmitted to a monitor so the movement of a body part or of an instrument or contrast agent ("X-ray dye") through the body can be seen in detail.

Computed tomography (CT): sometimes called "computerized tomography" or "computed axial tomography" (CAT), is a non-invasive medical examination or procedure that uses specialized X-ray equipment to produce cross-sectional images of the body. Each cross-sectional image represents a "slice" of the person being imaged, like the slices in a loaf of bread. These cross-sectional images are used for a variety of diagnostic and therapeutic purposes. CT scans can be performed on every region of the body for a variety of reasons (e.g., diagnostic, treatment planning, interventional, or screening). Most CT scans are performed as outpatient procedures.

Computed tomography (CT) fluoroscopy: combines the conventional advantages of both CT and fluoroscopy and has an important role in image-guided interventions where real-time imaging is required. It combines the cross-sectional image targeting provided by CT with the real-time imaging, tracking and movement perception of fluoroscopy for interventional procedures. Fluoroscopy, CT and CT fluoroscopy include radiation exposure (x-ray).

Magnetic Resonance Imaging (MRI): is a medical imaging procedure for making images of the internal structures of the body. MRI scanners use strong magnetic fields and radio waves (radiofrequency energy) to make images. The signal in an MR image comes mainly from the protons in fat and water molecules in the body.

During an MRI exam, an electric current is passed through coiled wires to create a temporary magnetic field in a patient's body. Radio waves are sent from and received by a transmitter/receiver in the machine, and these signals are used to make digital images of the scanned area of the body. A typical MRI scan lasts from 20-90 minutes, depending on the part of the body being imaged.

For some MRI exams, intravenous (IV) drugs, such as gadolinium-based contrast agents (GBCAs), are used to change the contrast of the MR image. Gadolinium-based contrast agents are rare earth metals that are usually given through an IV in the arm.

Ultrasound imaging (sonography): uses high-frequency sound waves to view the inside of the body. Because ultrasound images are captured in real-time, they can also show the movement of the body's internal organs as well as blood flowing through the blood vessels. Unlike X-ray imaging, there is no ionizing radiation exposure associated with ultrasound imaging.

In an ultrasound exam, a transducer (probe) is placed directly on the skin or inside a body opening (e.g., vagina). A thin layer of gel is applied to the skin so that the ultrasound waves are transmitted from the transducer through the gel into the body.

The ultrasound image is produced based on the reflection of the waves off of the body structures. The strength (amplitude) of the sound signal and the time it takes for the wave to travel through the body provide the information necessary to produce an image.

Spine: the flexible bone column extending from the base of the skull to the tailbone. It is made of 33 bones known as vertebrae and is referred to as the vertebral column, spinal column or backbone.

Cervical spine: the neck region of the spine consisting of the first seven vertebrae.

Thoracic spine: the region of the spine attached to the ribcage; located between the cervical and lumbar areas, it consists of twelve vertebrae.

Lumbar spine: the lower back region of the spine consists of the five vertebrae between the ribs and the pelvis.

Nerves: neural tissue that conducts electrical impulses (messages) from the brain and spinal cord to all other parts of the body; also conveys sensory information from the body to the central nervous system. The spinal nerves are numbered according to the vertebrae above which it exits the spinal canal. The eight cervical spinal nerves are C1 through C8, the twelve thoracic spinal nerves are T1 through T12, the five lumbar spinal nerves are L1 through L5, and the five sacral spinal nerves are S1 through S5. There is one coccygeal nerve.

Nerve root: the initial portion of a spinal nerve as it originates from the spinal cord.

Sciatica: a lay term indicating pain along the course of the sciatic nerve, typically noted in the back of the buttocks and running down the back of the leg and thigh to below the knee.

Spinal canal: a bony channel located in the vertebral column that protects the spinal cord and nerve roots.

Spinal cord: the longitudinal cord of nerve tissue enclosed in the spinal canal. It serves as a pathway for nerve impulses to and from the brain and as a centre for operating and coordinating reflex actions independent of the brain.

Spinal stenosis: abnormal narrowing of the vertebral column that may result in pressure on the spinal cord, spinal sac or nerve roots stemming from the spinal cord.

Vertebrae: the 33 bones that make up the spine, individually referred to as a vertebra. They are divided into the cervical spine (neck), the thoracic spine (upper back or rib cage), the lumbar spine (lower back) and the sacral spine (pelvis or base of the spine).

Facet: a joint formed when a posterior structure of a vertebra that joins with a facet of an adjacent vertebra; this joint allows for motion in the spinal column. Each vertebra has a right and left superior (upper) facet and a right and left inferior (lower) facet.

Disc (Intervertebral): a tough, elastic cushion located between the vertebrae in the spinal column; acts as a shock absorber for the vertebrae.

Disc degeneration: the deterioration of a disc. A disc in the spine may wear out over time. A deteriorated disc may or may not cause pain.

Foramen: an opening in the vertebrae of the spine through which the spinal nerve roots travel.

Lamina: the flattened or arched part of the vertebral arch that forms the roof or back part of the spinal canal.

Neural arch: the bony arch of the back part of a vertebra that surrounds the spinal cord; also referred to as the vertebral arch, it consists of the spinous process and lamina.

Executive Summary

Introduction

chronic spinal pain

most prevalent disease

Chronic spinal pain is the most prevalent chronic disease globally: the pain is most present in the lower back at 43%, the neck at around 32%, and the thoracic spine at 13%. A high burden of disease arises from chronic pain conditions and functional impairments leading to an impairment of the quality of life, inability to work, and psychological and social consequences.

image-guided injections often performed to reduce pain

Image-guided epidural injections are one of the most performed invasive non-surgical procedures in managing chronic spinal pain with or without extremity pain, in different indications like herniated discs, spinal stenosis, axial discogenic pain, and post-surgery syndrome. Epidural injections are provided through caudal, interlaminar, and transforaminal approaches. Facet joint injections target the small joints linking the spinal vertebrae, known as the facet joints.

Imaging technology: computer tomography or fluoroscopy

Epidural injections and facet joint injections are image-guided interventions, using fluoroscopy or computed tomography (CT), to reach the correct anatomical target, documenting the needle placement and contrast distribution, allowing the identification of inadvertent punctures and the subsequent correction of the needle position. Other image-guided technologies like ultrasound or magnetic resonance imaging (MRI) have been used for needle guidance in spinal injections, but less frequently.

primary aim: synopsis of guideline recommendations

The project aimed to identify the therapeutic indications for using image-guided spinal injections (with local anaesthetic and/or steroids) to treat chronic spinal pain based on clinical guidelines (CGs) and to perform a synopsis of evidence-based recommendations for each indication. The report also addresses potential organisational and social aspects to support the evidence-based decision-making process in Austria.

Methods

systematic literature search

A systematic literature search was performed in three medical databases (MEDLINE via Ovid, Embase, and Cochrane (CENTRAL) using a 5-year search period (2018-2023). A targeted hand search in the GIN database and the National Guideline Clearinghouse complemented the systematic search. CGs that were not updated or without literature search in the last five-year period were excluded. We extracted data on epidural injections and facet joint injections. For epidural injections, original recommendations from each CG were extracted in four indications: axial discogenic pain, disc herniation, spinal stenosis and post-surgery syndrome. For facet joint injections, recommendations were extracted for one indication: axial facet joint pain. Data were structured according to the three spinal levels (cervical, thoracic and lumbar). Three different approaches (access modes) were presented (transforaminal, interlaminar and caudal), as well as two for facet joint injections (facet joint nerve block and intraarticular injections).

for evidence-based guidelines

In addition, recommendations for different imaging technologies were extracted: related to fluoroscopy, CT, CT-fluoroscopy and ultrasound. The original level of evidence and grade of recommendations were extracted for each CG recommendation, regardless of source or methodology, on how clinical guidelines formulated the level of evidence and the strength of their recom-

mendations. A qualitative synopsis of recommendations for each indication was conducted by modification of two previously published classifications. Quality assessment of CGs was provided using AGREE-II by one person controlled by a second person.

EUnetHTA Core Model to structure results for other domains

The European Network for Health Technology Assessment Core Model® was used for organisational and social aspects, as an orientation for literature search and categorising the results into themes. For these domains, we used broader inclusion criteria and conducted a non-systematic focused search for relevant literature.

Results

Summary of clinical guidelines recommendations

10 guidelines:

Ten clinical guidelines fulfilled our eligibility criteria. Seven were related to epidural injections in four indications (axial discogenic pain, disc herniation, spinal stenosis, post-surgery syndrome) and five clinical guidelines on facet joint injections in one indication (axial facet joint pain). The majority are related to the lumbar spine. Only three guidelines on epidural injections and four on facet joint injections provided recommendations on imaging modalities.

inconsistent recommendations in 3 indications

The synopsis of recommendation for epidural injections is inconsistent in two clinical indications, axial discogenic pain and spinal stenosis, with conflicting recommendations across CGs. The same is true for facet joint injections, for both nerve block and intraarticular injections.

positive recommendations in 2 indications

The other two clinical indications for epidural injections, disc herniation and post-surgery syndrome, included both strong and weak recommendations for using epidural injections.

fluoroscopy most often mentioned imaging technology

If CGs stated an imaging technique, all referred to fluoroscopy in epidural injections. For facet joint interventions, fluoroscopic or CT are mentioned. Only one low-quality CG mentioned ultrasound for cervical medial branch block.

quality of guidelines mostly moderate

The overall quality of the guidelines ranged from low to high; most were of moderate quality. Only two guidelines were of high quality, not recommending the intervention in indications with contradictory recommendations.

Summary of organisational and social aspects

organisational and social aspects:

Regarding health care settings and patient/participant flow, observational studies noted that shifting spine interventional pain injections from a hospital-based setting to a clinic-based outpatient setting could result in decreased procedural, fluoroscopic, and wait times and a decrease in health system costs.

several context factors such as radiation dose and preference

Several factors may influence the decision on which imaging modality to use for nerve root blocks or epidural injections, like the availability of examination slots in the CT or fluoroscopy unit, considerations about safety and radiation dose, or preference by the interventionalist or the referring physician.

CT with highest radiation dose

The main advantage of CT guidance for spinal interventions is related to more accurate needle tip positioning. Comprehensive knowledge of appropriate radiation dose reduction strategies is of utmost importance to reduce the dose to the patient, physician and all staff involved. The same is true for spinal injections when guided under fluoroscopy. Some observational studies pointed out that facet joint injections can be done under ultrasound guidance with equivalent efficacy to fluoroscopic guidance, but obese patients

may present a challenge due to its poor visualization of deep anatomical structures. Further research is needed to understand the exact role of ultrasound in image-guided injections.

standards of good practice

In Europe, standards of good practice for spinal interventional procedures in pain medicine are available and should be followed. Standards are related to environment and facilities, monitoring, assistance, fluoroscopy, record keeping as well as follow-up and discharge planning.

Research is needed on patient preferences for these interventional procedures for the treatment of chronic spinal pain. Patients require sufficient information to be able to make informed decisions.

Discussion and conclusion

positive recommendations for 2 indications and

For two indications, **disc herniation and post-surgery syndrome**, the synopsis of recommendation pointed to **both strong and weak recommendations for using this intervention**. In the indication of disc herniation, epidural injections guided by fluoroscopy seem to be the most appropriate for the lumbar spine.

inconsistent recommendations for 3 indications

In the **other two indications** of epidural injections (**axial discogenic pain and spinal stenosis**) and concerning **facet joint injections** in **axial facet joint pain**, **recommendations** regarding image-guided injections are **contradictory**.

in different spine levels

Concerning spine level, guidelines mainly addressed the lumbar spine and, to a lesser extent, the cervical spine, while the least information is available on the thoracic spine level (no information for the indications of axial discogenic pain, spinal stenosis, or post-surgery syndrome), probably because the spinal pain is rarely present in the thoracic spine.

further routine data analysis may be used for these indications with inconsistent guideline recommendations

As a next step indication-specific routine data analysis could be undertaken to evaluate, based on the findings of our report, whether the image guided injections are used adequately or overused in clinical practice. In the latter scenario, measures should be implemented to ensure that physicians considering injections in indications with contradictory recommendations or in spine levels with missing recommendations carefully discuss such treatments with their patients and **avoid possible overtreatment, adverse effects, and unnecessary radiation exposure** related to fluoroscopy or CT image-guided technologies. These seem even more important in axial discogenic pain and spinal stenosis, as in the guidelines with the highest quality, recommendations were against using the intervention. Patients generally require sufficient information to make in-formed decisions.

no clear recommendations for specific imaging technologies

There are no clear recommendations for or against a specific imaging technology. **Fluoroscopy may be given preference for safety reasons** due to lower radiation exposure for patients.

Even though **other imaging technologies** such as ultrasound may be attractive (e.g., no radiation exposure, cheaper, requiring less infrastructure and logistics), the guideline which mentioned it for cervical medial branch block is of low quality and further research is needed before considering ultrasound in routine use.

final choice context-dependent

The final choice for imaging technology, in both epidural injections and facet joint injections, also depends on the organisational context and available infrastructure or preference by the interventionalist or the referring physician.

Zusammenfassung

Hintergrund

chronische Rückenschmerzen

Über einen längeren Zeitraum andauernde Rückenschmerzen sind weltweit die am weitesten verbreitete chronische Erkrankung: Am häufigsten treten die Schmerzen im unteren Rückenbereich (Kreuzschmerzen) und in der Halswirbelsäule auf. So gaben etwa bei der für die österreichische Bevölkerung ab 15 Jahren repräsentativen Gesundheitsbefragung 2019 1,9 Mio. Menschen an, in den letzten zwölf Monaten von chronischem Kreuzschmerz oder Rückenleiden betroffen gewesen zu sein. Frauen leiden dabei etwas häufiger an chronischem Kreuzschmerz als Männer (27,3 % im Vergleich zu 24,5 %). Von chronischen Nackenschmerzen waren 19,5 % der Bevölkerung betroffen, Frauen ebenfalls öfter als Männer (24,8 % bzw. 14,0 %). Für die von Rückenschmerzen Betroffenen entsteht wegen des anhaltenden Schmerzzustands und der Funktionsbeeinträchtigung häufig eine hohe Belastung. Dies kann zu einer Beeinträchtigung der Lebensqualität, bis hin zu Arbeitsunfähigkeit, sowie zu psychischen und sozialen Folgen führen.

globale bedeutende Krankheitslast

krankhafte Veränderungen der Bandscheiben als häufige Ursache

Häufige Gründe für chronische Rückenschmerzen sind krankhafte Veränderungen im Bereich der Bandscheiben. Je nach Grad der Schädigung werden drei Formen des Bandscheibenschadens unterschieden: die Bandscheibenvorwölbung (Protrusion), der Bandscheibenvorfall (Prolaps) oder der sequestrierte Bandscheibenvorfall (wenn Bandscheibengewebe in den Wirbelkanal tritt). Kommt es durch den Bandscheibenschaden zu einer Nervenreizung, durch Irritation oder Kompression, führt dies zu Schmerzen. Diese werden als Radikulopathie oder Wurzelreizsyndrom bezeichnet. Eine Spinalkanalstenose (Verengung des Wirbelkanals) ist meist durch degenerative Veränderungen bedingt und kann ebenfalls zu radikulären, also die Wurzel betreffenden, Schmerzen führen.

neben konservativen Maßnahmen gibt es auch minimal-invasive Eingriffe wie etwa bildgesteuerte Infiltrationen

Für die Behandlung von chronischen Rückenschmerzen existieren zahlreiche Leitlinien. Wenn konservative Maßnahmen Schmerzen nicht wirksam lindern, kommen u. a. Infiltrationen eines Gemischs aus Kortikosteroiden und Lokalanästhetikum in den betroffenen Wirbelsäulenbereich unter Bildsteuerung zum Einsatz. Diese Gemische können in den sogenannten Epiduralraum (einen spaltförmigen Raum in der Wirbelsäule) oder in das Facettengelenk (Wirbelbogengelenk) injiziert werden.

international dominieren unterschiedliche bildgebende Verfahren: Fluoroskopie vs. Computertomographie (CT)

Es werden international unterschiedliche bildgebende Technologien eingesetzt, um eine punktgenau Injektion der Medikamente am schmerzauslösenden Ort verabreichen zu können: Im deutschsprachigen Raum scheint dazu vorwiegend die Computertomographie verwendet zu werden. In anderen Ländern dominieren andere Verfahren wie etwa eine sogenannte Durchleuchtung mittels Fluoroskopie. Während bei beiden Verfahren Röntgenstrahlung verwendet wird, ist diese bei der Fluoroskopie deutlich geringer.

Aus der Sicht der Entscheidungsträger ist es derzeit unklar, ob bildgesteuerte Infiltrationen in Österreich immer angemessen zum Einsatz kommen.

Ziel dieses Berichts ist es, anhand von klinischen Leitlinien die sinnvollen Einsatzgebiete der bildgesteuerten rückenmarksnahen Infiltration zu identifizieren und die in den Leitlinien angeführten Empfehlungen zusammenzufassen. Zudem soll überprüft werden, welche Rolle der CT-gezielten Infiltration in Bezug auf die unterschiedlichen Arten der Bildgebung zugeschrieben wird. Der Bericht wird auch auf mögliche organisatorische und soziale Aspekte eingehen, um für Entscheidungen relevante Kontextfaktoren zu berücksichtigen.

Ziel des Projekts: Synopse von Leitlinienempfehlungen zu Indikationen, Bildgebungsverfahren und Beschreibung weiterer Aspekte

Methoden

Für die Leitlinienübersicht führten wir eine systematische Literaturrecherche in drei medizinischen Datenbanken (MEDLINE über Ovid, Embase und Cochrane (CENTRAL)) über einen Suchzeitraum von fünf Jahren (2018-2023) durch. Außerdem wurden die GIN-Datenbank und das National Guideline Clearinghause als Quellen für eine zusätzliche manuelle Suche herangezogen. Eingeschlossen wurden rezente Leitlinien, die thematisch relevante Empfehlungen zu epiduralen Injektionen und Facettengelenkinjektionen abgegeben haben. Die Qualitätsprüfung der Leitlinie führten wir mit dem Tool „AGREE-II“ durch. Wir extrahierten Empfehlungen (inkl. Evidenzgrad und Empfehlungsgrad) und dazugehörige Textpassagen bzw. Aussagen, kategorisierten diese nach Indikationen und fassten die Ergebnisse narrativ zusammen.

systematische Literatursuche nach evidenzbasierten Leitlinien

Literatur zu organisatorischen und sozialen Aspekten wurde zum einen aus der oben genannten systematischen Literaturrecherche identifiziert. Zusätzlich erfolgte eine fokussierte manuelle Literatursuche. Das European Network for Health Technology Assessment Core Model® diente als Orientierung für die Einteilung der Ergebnisse in Themen.

ergänzende Beschreibung organisatorischer und sozialer Aspekte

Ergebnisse

Leitlinienempfehlungen

Zehn Leitlinien erfüllten die Einschlusskriterien: Sieben davon enthielten Empfehlungen zu epiduralen Injektionen bei vier Indikationen (axiale diskogene Schmerzen, Bandscheibenvorfall, Spinalkanalstenose, postoperatives Syndrom). Fünf Leitlinien enthielten Empfehlungen zu Facettengelenkinjektionen bei einer Indikation (axiale Facettengelenkschmerzen). Die Mehrzahl der Leitlinien bezog sich auf die Lendenwirbelsäule. Nur drei Leitlinien zu epiduralen Injektionen und vier zu Facettengelenksinjektionen enthielten Empfehlungen zu bildgebenden Verfahren.

10 Leitlinien

Bei zwei Indikationen (Bandscheibenvorfall; postoperatives Syndrom) wurde sowohl eine starke als auch eine schwache Empfehlung für epidurale Injektionen unter Bildgebung ausgesprochen, wobei die meisten Empfehlungen den Lendenwirbelbereich betreffen.

positive Empfehlung bei 2 Indikationen und

Bei den anderen Indikationen waren die Leitlinienempfehlungen uneindeutig oder widersprüchlich: Epidurale Injektionen unter Bildgebung bei axialen Schmerzen bzw. bei Spinalkanalstenosen wurden von manchen Leitlinien empfohlen, während andere Negativ-Empfehlungen (sog. „do not use“-Empfehlungen) in diesen Indikationen im Lendenwirbelbereich aussprachen. Teilweise widersprüchlich waren auch die Leitlinienempfehlungen zu bildgesteuerten Facettengelenksinjektionen bei axialen Facettengelenksschmerzen, die sowohl positive als auch negative Empfehlungen aufwiesen.

widersprüchliche oder uneindeutige Empfehlungen bei 3 Indikationen

keine Empfehlungen zu spezifischen bildgebenden Verfahren

Wenn die Leitlinien ein konkretes bildgebendes Verfahren angaben, bezogen sich bei epiduralen Injektionen alle auf die Fluoroskopie. Bei Injektionen an den Wirbelgelenken wurden Fluoroskopie oder CT genannt. Nur in einer Leitlinie von geringer Qualität wurde Ultraschall (für Facettengelenskinjektionen im Halswirbelbereich) als bildgebendes Verfahren erwähnt.

Qualität der Leitlinien vorrangig moderat

Die meisten Leitlinien waren von moderater Qualität. In jeweils zwei der zehn Leitlinien wurde die Qualität als hoch bzw. niedrig eingestuft, wobei jene mit hoher Qualität im Fall von widersprüchlichen Empfehlungen bei einer Indikation (axiale Schmerzen, Spinalkanalstenose) eine Empfehlung gegen den Einsatz von Injektionen unter Bildgebung aussprachen.

Organisatorische und Soziale Aspekte

organisatorische und soziale Aspekte:

Die Entscheidung, welche Bildgebungsmodalität verwendet werden soll, kann von mehreren Faktoren beeinflusst werden, z. B. von der Verfügbarkeit von Untersuchungsplätzen in der CT-Einheit oder der Durchleuchtungseinheit, von Überlegungen zur Sicherheit und Strahlendosis oder von der Präferenz des Gesundheitspersonals (Interventionist:innen oder überweisende Ärzt:innen).

Setting

In Bezug auf die Rahmenbedingungen des Gesundheitswesens und die Patient:innen-/Teilnehmerströme wurde in Beobachtungsstudien festgestellt, dass die Verlagerung von Injektionen an der Wirbelsäule von einem krankenhausbasierten zu einem klinikbasierten ambulanten Setting zu kürzeren Verfahrens-, Fluoroskopie- und Wartezeiten sowie zu einer erheblichen Senkung der Kosten für das Gesundheitssystem führen könnte.

Präferenzen, Strahlenbelastung, Zugang etc.

Der Hauptvorteil der CT- oder Fluoroskopie-gesteuerten Wirbelsäuleneingriffe liegt in der genaueren Positionierung der Nadelspitze. Strategien zur Reduzierung der Strahlendosis sind von großer Bedeutung, damit diese sowohl für die Patient:innen als auch das Gesundheitspersonal auf ein Minimum reduziert wird. Einige Beobachtungsstudien deuten darauf hin, dass Injektionen in die Facettengelenke unter Ultraschallkontrolle mit gleicher Wirksamkeit wie unter Durchleuchtung durchgeführt werden können. Das hätte Vorteile bezüglich Strahlenbelastung, Kosten und Organisation. Jedoch wird die schlechte Sichtbarkeit tiefer anatomischer Strukturen vor allem bei adipösen Patient:innen als besondere Schwierigkeit erwähnt. In der Literatur wird daher betont, dass weitere Forschung erforderlich ist, um die genaue Rolle des Ultraschalls bei bildgesteuerten Injektionen zu verstehen.

Standards für die Praxis in Europa vorhanden

In Europa gibt es Standards für die Praxis bei interventionellen Wirbelsäuleneingriffen in der Schmerzmedizin, die befolgt werden sollten. Die Standards beziehen sich auf Umgebung und die Einrichtungen, die Überwachung, die Assistenz, die Fluoroskopie und die Dokumentation.

Diskussion und Schlussfolgerung

sowohl Indikationen mit eindeutigen als auch widersprüchlichen Empfehlungen identifiziert

Während evidenzbasierte Leitlinien Injektionen unter Bildgebung in manchen Indikationen (Bandscheibenvorfall, postoperatives Syndrom) als Behandlungsoptionen empfahlen, gab es auch Indikationen (axialer diskogener Schmerz, Spinalkanalstenose und axiale Facettengelenkschmerzen) mit insgesamt uneindeutigen und teilweise widersprüchlichen Leitlinienempfehlungen.

keine klare Empfehlung für oder gegen bestimmtes bildgebendes Verfahren

Keine der Leitlinien sprach eine klare Empfehlung für oder gegen ein bestimmtes bildgebendes Verfahren aus. Allerdings stellten manche Leitlinien (wie etwa eine rezente AWMF S2k Leitlinie) die Durchleuchtung mit Fluoroskopie – vor dem Hintergrund der geringeren Strahlenbelastung für die Patient:innen – in manchen Indikationen als bevorzugte Option dar. Andere Bildgebungsverfahren, wie Ultraschall, kommen in den Leitlinien praktisch nicht vor und auf Basis der zusätzlich analysierten Literatur scheint deren Einsatz vorerst auf Forschungszwecke zu beschränkt zu sein.

Als nächsten Schritt könnten indikationsspezifische Versorgungsdatenanalysen durchgeführt werden, um festzustellen, ob die Injektionen in der klinischen Praxis angemessen oder übermäßig eingesetzt werden. Im letzteren Fall sind Maßnahmen denkbar, die eine sorgfältige Abwägung sicherstellen, um eine mögliche Überbehandlung, unerwünschte Wirkungen und unnötige Strahlenbelastung im Zusammenhang mit Fluoroskopie- oder CT-gesteuerten Technologien zu vermeiden. Dies scheint bei axialen diskogenen Schmerzen und Spinalkanalstenose besonders wichtig zu sein, da in den Leitlinien mit höchster Qualität Empfehlungen gegen den routinemäßigen Einsatz des Eingriffs ausgesprochen wurden. Die Patient:innen benötigen im Allgemeinen ausreichende Informationen, um eine informierte Entscheidung treffen zu können.

Wahl der Bildgebungstechnologie auch abhängig vom organisatorischen Kontext

Die endgültige Wahl der Bildgebungstechnologie hängt bei epiduralen Injektionen sowie bei Facettengelenksinjektionen auch vom organisatorischen Kontext und der verfügbaren Infrastruktur ab. Bei Steuerungsmaßnahmen für einen angemessenen Einsatz sind diese Kontextfaktoren ebenso zu berücksichtigen, wie die Unterscheidung nach Indikation.

1 Introduction

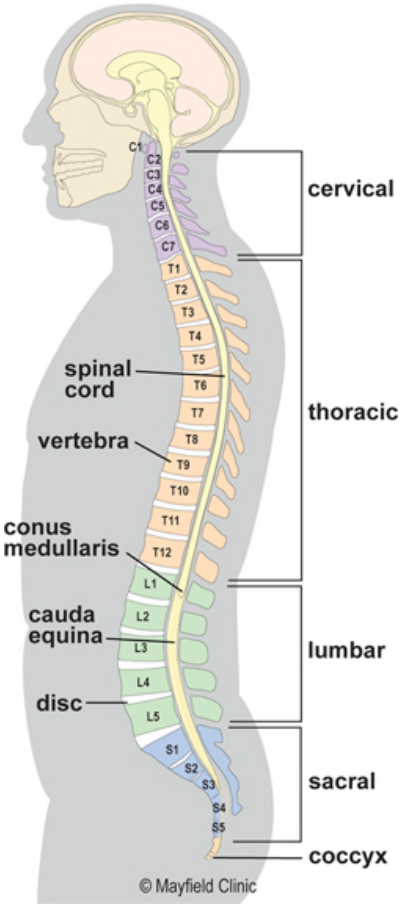
1.1 Chronic spinal pain

chronische Rückenschmerzen weltweit verbreitet

Chronic spinal pain is the most prevalent chronic disease across the globe: the pain is most present in the lower back at 43%, followed by the neck at around 32%, and the thoracic spine at 13%. Intervertebral discs, facet joints, sacroiliac joints, and nerve root dura are proven pain generators in the spine (Figure 1-1 and Figure 1-2) [6].

können akut, subakut oder chronisch auftreten

Low back pain (LBP) is pain between the lower edge of the ribs and the buttock. It can be acute (lasting under six weeks or 1-4 weeks), sub-acute (6-12 weeks or 5-12 weeks) or chronic (over 12 weeks)[7]. In 2020, low back pain (LBP) affected 619 million people globally. The number of cases is projected to increase to 843 million by 2050 due to population expansion and ageing [6, 8, 9].



Abbreviations:
C=cervical;
T=thoracic;
L=lumbar;
S=sacral

Figure 1-1: The five regions of the spinal column (Source: [4])

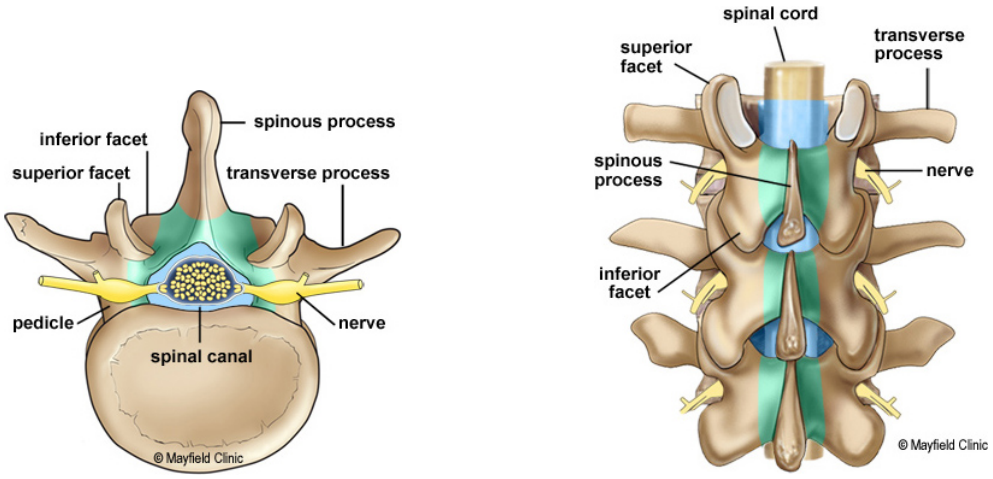


Figure 1-2: The vertebral arch (green) forms the spinal canal (blue) through which the spinal cord runs. Seven bony processes arise from the vertebral arch to form the facet joints and processes for muscle attachment (Source: [4])

in etwa 1,9 Mio Österreicher:innen betroffen

According to the 2019 Austrian Health Survey, 1.9 million people reported being affected by chronic low back pain or another chronic back condition in the past twelve months. Women are slightly more likely than men to be affected by chronic low back pain (27.3% and 24.5%, respectively). Chronic low back pain is second only to allergies among the most frequently mentioned chronic conditions among those under 45. In the 45-59 age group, chronic low back pain is the most commonly reported chronic condition. In the 60-plus age group, chronic low back pain was surpassed only by hypertension. Chronic neck pain affected 19.5% of the population, and women also more often than men (24.8% and 14.0%, respectively). The Austrian Health Survey surveyed the health status of 15,461 people between October 2018 and September 2019. The results are representative of the Austrian population aged 15 years and older [10]. For those affected by back pain, a high burden arises from the chronic pain condition and from functional impairments. This leads to an impairment of the quality of life, inability to work, and psychological and social consequences [11].

und häufig durch schlechte Körperhaltung ausgelöst

Years of poor posture and wear and tear often lead to disc degeneration, which is not immediately associated with pain. However, the typical shooting pain can be triggered at any time by a jerky twist of the spine or an awkward movement and may be worsened by injury from daily activities and sports. This leads to disc space collapse and disc resorption as the nucleus pulposus streams out through the tears, causing the disks to bulge, protrude or rupture, leading to herniated discs. A herniated disc is a displacement of disc material (nucleus pulposus or annulus fibrosis) beyond the intervertebral disc space. Disc displacement may present as internal disc disruption, disc prolapse, disc protrusion, disc extrusion, disc herniation, or discogenic pain [6]. Suppose the disc herniation leads to nerve irritation, irritation, or compression. In that case, this leads to more or less severe pain, which is referred to as radiculopathy or root irritation syndrome (in most cases eradiating into the leg and in severe cases accompanied by deficits of sensibility or paresis of specific muscles) [11]. Degenerative changes usually cause spinal canal stenosis (narrowing of the spinal canal) and can also lead to radicular symptomatology [11]. Regarding the facet joints as one of the proven causes of chronic spinal pain, the prevalence of facet joint pain is 27% to 41% in the

lower back, 36% to 67% in the cervical spine, and 34% to 48% in the thoracic spine [12]. Additionally, epidural fibrosis can cause pain and disability in the low back and lower extremities following lumbar spine surgery [7].

minimal-invasive Behandlungsansätze:

Multiple invasive non-surgical treatment modalities are currently available for chronic spinal pain, e.g., image-guided spinal epidural injections, including nerve root injections, facet joint injections, medial branch block injections with local anesthetics and/or steroids [6, 13, 14] [12].

Radiofrequenzablation, bildgesteuerte Injektionen, perkutane Adhäliolyse

Different facet joint interventions are used to manage chronic axial spinal pain when facet joints are the proven causes of pain, e.g., radiofrequency ablation, therapeutic facet joint medial branch nerve blocks, or intraarticular facet joint injections [12]. Percutaneous adhesiolysis is another treatment modality provided through caudal, interlaminar, and transforaminal approaches in the lumbar spine in patients with post-lumbar surgery syndrome and spinal stenosis which failed to respond to or poorly responded to noninterventional and nonsurgical conservative management and fluoroscopically directed epidural injections [6].

1.2 Image-guided epidural injections and facet joint-injections (with local anaesthetics and/or steroids)

häufig bildgesteuerte Injektionen in Epiduralraum

Image-guided epidural injections are one of the most performed invasive non-surgical procedures in managing chronic spinal pain with or without extremity pain. Epidural injections can be used in pain treatment and disability secondary to herniated discs, spinal stenosis, axial discogenic pain, and post-surgery syndrome [6].

um ein Gemisch aus Kortikosteroiden und Lokalanästhetikum punktgenau zu injizieren

The epidural space lies within the spinal canal, outside the dura mater, and contains fat, connective tissue, and blood vessels. An epidural injection is an injection of a therapeutic substance into this canal [15].

Epidural injections are provided through caudal, interlaminar, and transforaminal approaches (Figure 1-3).

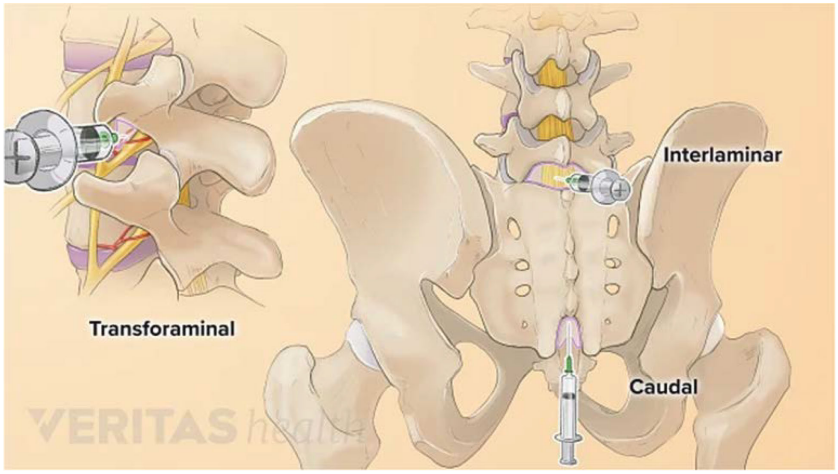


Figure 1-3: Epidural injection approaches (Source: [5])

verschiedene Applikationen (kaudal, transforaminal, interlaminar)

An interlaminar or transforaminal approach is used in the lumbar, cervical, or thoracic spine. Caudal procedures are performed for lumbosacral disorders. Caudal and interlaminar epidurals are common procedures, especially for central stenosis of the spinal canal. In cases of mono segmental radicular pains and/or neuroforaminal stenosis, transforaminal epidural injections are used, [6, 16]. The caudal approach may be advantageous in patients with previous spine surgeries (i.e., a lumbar fusion or laminectomy), in which cases it may be unsafe or anatomically impossible to utilize the interlaminar or transforaminal approach [14] but has only possible impact on structures below the level of L3/4.

weiterer Anwengungsbereich: Facettengelenke

Facet joint injections target the small joints linking the spinal vertebrae, known as the facet joints. Each vertebra has four facet joints: one pair that connects to the vertebra above (superior facets) and one pair that connects to the vertebra below (inferior facets) (Figure 1-4). Local anesthetic or steroid injections into selected joints are used to temporarily reduce or stop back pain. Medial branch blocks are injections of local anesthetic onto the medial branch nerves that supply the facet joints. It is usually done to define those that would respond to further procedure – (radiofrequency) denervation of the positive tested levels [15].

Bildgebung durch Computertomographie (CT), Fluoroskopie oder Ultraschall

Epidural injections and facet joint injections are image-guided interventions, using fluoroscopy or computed tomography (CT) to reach the correct anatomical target, documenting the needle placement and contrast distribution. This allows the identification of inadvertent punctures and the subsequent correction of the needle position [6, 15, 17, 18]. Other image-guided technologies like ultrasound or magnetic resonance imaging (MRI) have been used for needle guidance in spinal injections, but less frequently (MRI in academic research settings) [17]. The preferences regarding training experience, resource availability, and institutional policy often guide the choice of whether CT or fluoroscopy is used as a guidance technique [19].

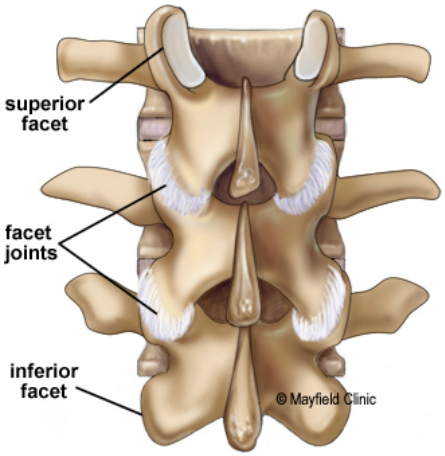


Figure 1-4: The superior and inferior facets connect each vertebra together. There are four facet joints associated with each vertebra (Source: [4])

gesicherte Indikationen unklar

Currently, it is not completely clear in which therapeutic indications the image-guided spinal injections (with local anesthetic and/or steroids) should be used in the treatment of chronic spinal pain according to (evidence-based) clinical guidelines (CGs).

1.3 Objective and scope

primäres Ziel: Leitlinienübersicht

This project aims to identify the therapeutic indications for using image-guided spinal injections (with local anesthetic and/or steroids) to treat chronic spinal pain based on CGs and perform a synopsis of evidence-based recommendations for each indication. The report also addresses potential organisational and social aspects to support the evidence-based decision-making process in Austria.

3 Forschungsfragen:

The following research questions (RQ) are answered:

Indikationen

- **RQ1:** What recommendations for or against image-guided spinal injections (with local anesthetic and/or steroids) are offered for specific indications by evidence-based CGs in treating chronic spinal pain?

Bildgebungstechnologien

- **RQ2:** What role is attributed to CT-guided spinal injections in relation to the different imaging modalities?

organisationale und soziale Aspekte

- **RQ3:** What are the potential organisational and social aspects related to image-guided spinal injections to be considered for clinical practice and implementation?

Scope according to the PICO framework

Table 1-1: PICO framework (Inclusion criteria for CGs synopsis and other domains)

Population	Patients with chronic spinal pain (e.g., related to herniated discs, spinal stenosis, axial discogenic pain, and in post-surgery syndrome) Spinal areas: cervical, thoracic, lumbar, sacral
Intervention	Image-guided spinal injections (e.g., Epidural injections – access transforaminal, interlaminar, caudal, nerve root injections, facet joint injections and facet joint medial branch nerve injections) with local anaesthetic and/or steroids using different image technologies (e.g., CT, fluoroscopy, ultrasound, MRI).
Control	-
Outcome	**(Evidence-based) CGs recommendations:** Indications, Level of Evidence (LoE) and Grade of Recommendation (GoR) **Other Domains:** **Organisational and Social** (*according to the EUnetHTA Core HTA Model® 3.0*) [20] i.e., on **Organisational:** ■ Implementation considerations (Facilities at different healthcare level, Specialists who perform the procedure, Accessibility, Resources availability, Training, Institutional policy, Quality assurance and monitoring system) **Social:** ■ Values and preferences of patients and physicians (i.e., on different image-guided technologies)
Setting	Countries of the Global North
Study Design	(Evidence-based) CGs Other Domains: e.g., CGs, systematic reviews (SRs) and other sources*
Publication period	2018-2023
Language	English, German

** Additional non-systematic screening of references was provided on studies with other designs, see in Methods*

2 Methods

Protokollregistrierung

The protocol was registered on the Open Science Framework (OSF) platform [21]. There was no deviation from the project plan, except that we added an inclusion criterion related to CGs literature date search period and that we conducted additional non-systematic screening for other domains, as explained below.

2.1 Literature search

Recommendations in (evidence-based) clinical guidelines

systematische Literatursuche in 3 Datenbanken

A systematic literature search of several databases (MEDLINE via Ovid, Embase, and Cochrane (CENTRAL) was performed without restriction from January 2018 to June 2023. A targeted hand search in the GIN database and the National Guideline Clearinghouse complements the systematic search. New inclusion criteria were added to avoid recommendations from CGs which are not updated in the last five-year period: only those guidelines with the last literature date search or last update after June 2018 were included. The detailed search strategies for each of the databases can be found in "Literature Search strategy" in the Appendix.

Studienselektion im Vier-Augen-Prinzip

Two persons (MH, GG) independently screened the titles and abstracts of the systematic literature search to identify potentially eligible studies. Full-text articles were obtained for all citations identified as potentially eligible. Both persons independently read these to establish the relevance of the articles according to the pre-specified criteria. References were included or excluded according to the Population-Intervention-Control-Outcome (PICO)-scheme (as described in the Scope, Table 1-1) and presented according to the PRISMA Statement [22]. The flow diagram depicting the selection process of clinical guidelines can be found below (see Figure 3-1).

Other domains

Identifizierung von Kontextfaktoren durch Handsuche

The non-systematic literature search and hand search for other domains were done by one person (MH) to find references with different study designs from January 2018 to June 2023.

2.2 Data extraction and management

Recommendations in (evidence-based) clinical guidelines

Datenextraktion

Extraction of recommendations for specific treatment indications in relation to different imaging-guided technologies (in addition to explicit recommendations, any statements about CT-guided injections were also extracted) was done by one person (MH) on pre-defined extraction tables and double-checked regarding completeness and accuracy by a second reviewer (GG). Any differences in extraction results were discussed to achieve consensus; any disagreements were resolved by involving a third reviewer (IZ).

Kategorisierung nach Indikationen und ...

We extracted data on a) epidural injections and b) facet joint injections. For epidural injections, original recommendations from each CG were extracted in four indications: Axial discogenic pain, Disc herniation, Spinal stenosis and Post-surgery syndrome. For facet joint injections, recommendations were extracted for one indication: Axial facet joint pain. Data were structured according to the three spinal levels (cervical, thoracic and lumbar).

... Zugang

For epidural injections, three different approaches (access modes) were presented (transforaminal, interlaminar and caudal), as well as two for facet joint injections (as facet joint nerve block and intraarticular injections). In addition, recommendations for different image-guided technologies were extracted related to fluoroscopy, CT, CT-fluoroscopy and ultrasound (US).

Empfehlungsstärke und Evidenzstufe

The original level of evidence and grade of recommendations were extracted for each CG recommendation, regardless of source or methodology, on how clinical guidelines formulated the level of evidence and the strength of their recommendations.

qualitative Synthese der Empfehlungen

Qualitative synthesis and comparison of recommendations for each indication was done by one person (MH) and controlled by a second person (GG). Summary tables were created for each indication. To provide a synopsis of recommendations for each indication, we modified two classifications used previously by Olivier et al. 2023 [23] and Khorami et al. 2021 [24]. The categories used are described below in Table 2-1:

Table 2-1: Classification for synopsis of recommendations

Classification of recommendations	Explanation	Symbols used
Strong recommendation for or against	Majority recommendations (≥80%; GoR: strong or A; LoE I, I-A or high; wording as "do not offer", or in consensus) indicate "in support" or "against", but with no conflicting recommendations across guidelines;	↑↑ (for use) ↓↓ (against use)
Weak recommendation for or against	Majority recommendations (≥80%; GoR: moderate to weak or ≤B; LoE I-B, ≤ II or moderate to low; wording as "consider" and "can be"; or in consensus <80%) indicate "in support" or "against", but with no conflicting recommendations across guidelines; following symbols were used related to Weak recommendation for using an intervention ↑? and Weak recommendation against using an intervention ↓?	↑? (for use) ↓? (against use)
Strong and weak recommendation for or against	When both, strong and week recommendation for or against using an intervention is applied for the same recommendation in different guideline, but with no conflicting recommendations across guidelines	↑↑ (for use) and ↑? (for use) ↓↓ (against use) and ↓? (against use)
Inconsistent recommendations	When at least one "in support" and at least one "against" is applied for the same recommendation in different guideline **or** when at least one "in support" and at least one "*neither in support nor against*" is applied for the same recommendation in different guideline **or** when at least one "against" and at least one "*neither in support nor against*" is applied for the same recommendation in different guideline	↑↑ (for use) or ↑? (for use) and ↓↓ (against use) or ↓? (against use) and/or ~ (neither in supports nor against)

Other Domains: Organisational and Social

identifizierte Kontextfaktoren

The European Network for Health Technology Assessment (EUnetHTA) Core Model® was used for organisational and social aspects, recognizing their importance in how they may influence the decision to use different image-guided technologies [20]. The Core Model lists topics that may be addressed to cover organisational and patients and social aspects. We used those as an orientation for the literature search and categorising the results into themes.

strukturiert durch EUnetHTA Core Model®

According to the EUnetHTA Core Model® Version 3.0 [20], the **Organisational aspects (ORG)** consider the ways in which different kinds of resources need to be mobilised and organised when implementing technology and the consequences they may further produce in the organisation and the health care system as a whole. Organisational issues include, e.g. work processes and patient/participant flow, quality and sustainability assurance, centralisation, communication and cooperation, and technology acceptance.

organisationale und ...

The setting (primary – secondary – tertiary care) for applying an intervention can vary between different countries depending on the health care system. (De)centralisation could have some economic and qualitative benefits. Centralisation could make the technology more difficult to access. Usually, expensive technologies are centralised to tertiary care units with specially educated staff. A new technology may require new kinds of professionals or new tasks for existing personnel. Patient/participant flow includes waiting times for diagnosis and/or treatment and waiting times for the analysis of the technology, all preparations that patients/participants need to make before and after, as well as the need for self/home monitoring. The impact of the technology on current pathways of care should be taken into account. It may, for example, shift towards community care or inpatient care. New technologies usually affect current quality assurance at different healthcare levels inside and outside the organisation. To assure quality, a monitoring system with standards and indicators is needed; there are also possible variations in how the quality assurance and monitoring system is implemented [20].

... soziale Aspekte

The **Patients and Social Aspects (SOC)** domain takes patients or individuals in whose care a health technology is used as a point of reference in an HTA. Patients, caregivers or individuals can provide unique perspectives about experiences, attitudes, preferences, values and expectations concerning health, illness, service delivery and treatments that can inform HTA [20].

narrative Beschreibung

Identified aspects/themes were narratively described based on available literature and structured accordingly. The results were presented in plain text format.

2.3 Quality assessment

Clinical guidelines

Qualitätsbewertung der Leitlinien durch 2 Personen mit dem AGREE-II Instrument

Quality assessment [25] was provided using AGREE-II (Appraisal of Guidelines for Research & Evaluation) by one person (MH) controlled by a second person (GG). The tool consists of 23 key items divided into six domains:

- *Domain 1. Scope and Purpose* is concerned with the overall aim of the guideline, the specific health questions, and the target population (items 1-3);
- *Domain 2. Stakeholder Involvement* focuses on the extent to which the guideline was developed by the appropriate stakeholders and represents the views of its intended users (items 4-6);
- *Domain 3. Rigour of Development* relates to the process used to gather and synthesize the evidence, the methods to formulate the recommendations, and to update them (items 7-14);
- *Domain 4. Clarity of Presentation* deals with the language, structure, and format of the guideline (items 15-17);
- *Domain 5. Applicability* pertains to the likely barriers and facilitators to implementation, strategies to improve uptake, and resource implications of applying the guideline (items 18-21); and
- *Domain 6. Editorial Independence* is concerned with the formulation of recommendations not being unduly biased with competing interests (items 22-23).

Each item is assigned a score from 1 (strongly disagree) to 7 (strongly agree). The score for each domain was obtained by adding up the scores of all the items in the domain. As the six domain scores are independent, they were not aggregated into a single quality score. As there is no standard quality threshold, decisions about how to define quality thresholds were made by consensus, using a further approach: We considered all domain scores, creating a threshold across all six domain scores. High-quality guidelines scored >70% in all six domains; moderate-quality guidelines scored >70% in four to five domains; and low-quality guidelines scored >70% in one to three domains.

Other domains

Various sources informed the description of these domains. As the primary aim for other domains was a concise description of potential organisational and social aspects, no quality assessment tool was used.

3 Results

3.1 Study selection

A literature search was conducted on June 02, 2023.

Literaturauswahl aus 1.503 Quellen

After deduplicating the results, 1,503 (1,496 citations plus 10 through other sources) remained for abstract screening. 1,454 references were excluded, and 49 references were left for the full-text screening.

Ten CGs formed our body of evidence related to epidural injections and facet joint injections (with local anaesthetic and/or steroids). Five were found by targeted hand search: one in National Guideline Clearinghouse and four in the reference lists of published articles (Table 3-1).

Table 3-1: List of included clinical guidelines for quality assessment related to epidural injections and facet-joint injections according to spinal area

Spinal injections and area	Clinical Guideline title/Abbreviation of Society	Publication date	Lit. search
Epidural injections			
Whole spine	Epidural Interventions in the Management of Chronic Spinal Pain: American Society of Interventional Pain Physicians (ASIPP) Comprehensive Evidence-Based Guidelines, [6] ASIPP	2021	From 1966 through November 2020
	Guideline for conservative, operative and rehabilitative Treatment of herniated discs with radicular symptoms. S2k guidelines of the German Society for Orthopedics and Orthopedic Surgery (DGOOC), the Spine Section of the German Society for Orthopedics and Trauma Surgery (DGOU), the German Society for Neurosurgery (DGNC) and the German Spine Society (DWG), [26] AWMF	2020	Last revision July 2020
Lumbar spine	The American Society of Pain and Neuroscience (ASPN) Evidence-Based Clinical Guideline of Interventional Treatments for Low Back Pain, [14] ASPN*	2022	From 2000-present? *Received for publication August 2022*
	Best Practices for Minimally Invasive Lumbar Spinal Stenosis Treatment 2.0 (MIST): Consensus Guidance from the American Society of Pain and Neuroscience (ASPN), [27] ASPN	2022	Through June 2019 Up to October 2020
	Non-Surgical Interventions for Lumbar Spinal Stenosis Leading To Neurogenic Claudication: A Clinical Practice Guideline, [28] USASP	2021	Up to October 2020
	Evidence-Based Clinical Guidelines for Multidisciplinary Spine Care: Diagnosis & Treatment of Low Back Pain, [29] NASS*	2020	To April 2016, Last update 1/27/2021
	Low back pain and sciatica in over 16s: assessment and management, [15] National Institute for Health and Excellence, NICE	2020	Last update September 2020 and December 2020
Facet Joint injections			
Whole spine	Comprehensive Evidence-Based Guidelines for Facet Joint Interventions in the Management of Chronic Spinal Pain: American Society of Interventional Pain Physicians (ASIPP) Guidelines, [12] ASIPP	2020	1966 through March 2020

Spinal injections and area	Clinical Guideline title/Abbreviation of Society	Publication date	Lit. search
Lumbar spine	The American Society of Pain and Neuroscience (ASPN) Evidence-Based Clinical Guideline of Interventional Treatments for Low Back Pain, [14] ASPN*	2022	From 2000-present? *Received for publication August 2022*
	Evidence-Based Clinical Guidelines for Multidisciplinary Spine Care: Diagnosis & Treatment of Low Back Pain, [29] NASS*	2020	To April 2016, Last update 1/27/2021
	Consensus practice guidelines on interventions for lumbar facet joint pain from a multispecialty, international working group, [30] IWG (Lumbar Facet)	2020	*Not found*
Cervical spine	Consensus practice guidelines on interventions for cervical spine (facet) joint pain from a multispecialty international working group, [31] IWG (Cervical Joint)	2022	*Not found*

** Presented twice in the table*

Abbreviations: AWMF: German Society for Orthopedics and Orthopedic Surgery (DGOOC), Spine Section of the German Society for Orthopedics and Trauma Surgery (DGOU), German Society for Neurosurgery (DGNC) and German Spine Society (DWG); ASPN: American Society of Pain and Neuroscience; USASP: US Association for the Study of Pain; NASS: North American Spine Society; IWG (Lumbar Facet): International working group (Lumbar Facet Intervention Guidelines Committee); IWG (Cervical Joint): International working group (Cervical Joint Working Group)

The flow diagram depicting the selection process of CGs can be found below (see Figure 3-1).

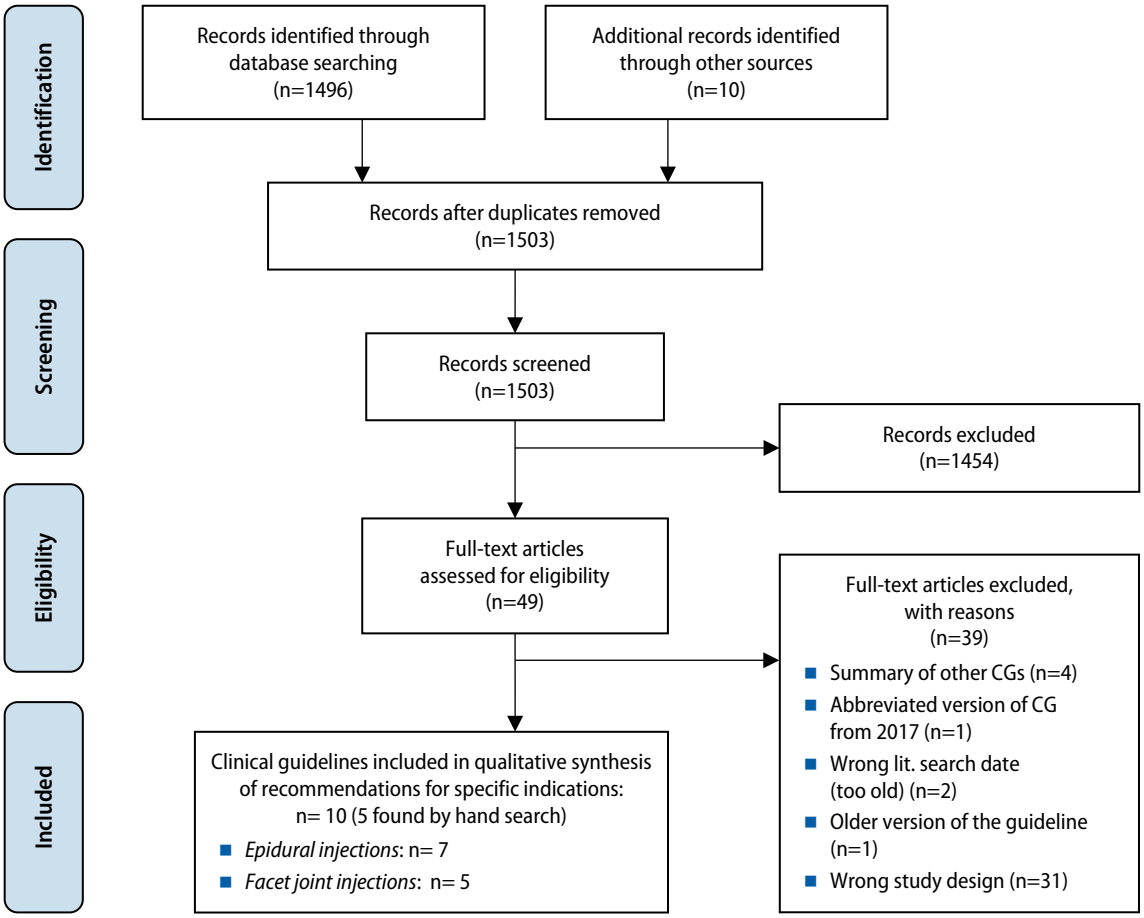


Figure 3-1: Flow chart of study selection (PRISMA Flow Diagram) for guideline synopsis

3.2 Synopsis of guideline recommendations

Empfehlungen aus 10 Leitlinien

Ten CGs were appraised for quality, and recommendations were extracted and summarised [6, 14, 15, 26-29] [12, 30, 31].

Recommendations related to **epidural injections** (with local anaesthetic and/or steroids) in four reported indications: **Axial discogenic pain, Disc herniation, Spinal stenosis and Post-surgery syndrome,** were extracted and presented from seven CGs (Table 3-1) [6, 14, 15, 26-29]. **Recommendations related to facet joint injections**, in one reported indication: **Axial facet joint pain,** were extracted and presented from five CGs (Table 3-1) [12, 14, 29-31]. Most CGs were related to lumbar spine.

Available **recommendations** related to **imaging modalities** for **epidural injections** were extracted and presented from three CGs (Table 3-1) [29] [6, 26]. Available recommendations related to **imaging modalities** for **facet joint injections** were extracted and presented from four CGs (Table 3-1) [29] [12, 30, 31].

mit vorwiegend moderater Qualität

The overall quality of the guidelines ranged from low to high. Two CGs were of high quality (USASP 2021, NICE 2020), and six CGs were of moderate quality (ASIPP 2021, AWMF 2020, ASPN 2022, NASS 2020, ASIPP 2020, IWG 2020). Two CGs were rated as low quality (ASPN 2022, IWG 2022) (Table A-1 in the Appendix). Two AGREE II domains, "Clarity of presentation" and "Scope and purpose", were the domains with the highest scores, and the domain "Applicability" had the lowest scores. Only two CGs have score above the used threshold in this report, >70% [15, 28].

3.2.1 Epidural injections (with local anaesthetic and/or steroids)

Indication: Axial discogenic pain

axiale diskogene Schmerzen:

Four CGs addressed epidural injections for axial discogenic pain [6] [14, 15, 29]. One is related to the cervical spine, none on the thoracic spine, and four CGs on the lumbar spine (Table 3-2).

4 Leitlinien:

In summary, only one CG related to the cervical spine provided moderate to strong recommendations for cervical interlaminar epidural injections. No recommendations were provided for the thoracic spine. Within four CGs which provided recommendations on the lumbar spine, conflicting recommendations were provided. Two CGs provided moderate to strong recommendations for interlaminar and caudal epidural injections, and one of them also provided strong recommendations for transforaminal access mode. One CG recommended neither in support nor against such epidural injections. One CG, which did not specify access mode, recommended against epidural injections; this is the only one of high quality. Other CGs are of moderate quality.

insg. uneindeutige bzw. widersprüchliche Empfehlungen im Lendenwirbelbereich

Two CGs pointed to fluoroscopy as the recommended image-guided technology. Overall, the recommendation is inconsistent regarding epidural injections for axial discogenic pain, with conflicting recommendations across CGs ("in support" or "against" or "neither in support nor against") (Table 3-2 below).

*Table 3-2: Summary of recommendations: **Epidural injections in Axial discogenic pain***

Spine level/ No of CGs	Access mode (No of CGs)	Imaging technology (No of CGs)	Recommendation (No of CGs)	GoR	Quality of CGs
Cervical					
1	Interlaminar (1)	Fluoroscopy (1)	√ (1)	Moderate to strong	😐
Thoracic					
n.r.	n.r.	n.r.	n.r.	/	/
Lumbar					
4	Interlaminar (3)	Fluoroscopy (2)	√ (2) ~ (1)	Moderate to strong I	😐
	Transforaminal (1)	n.r.	√ (1)	A	😐
	Caudal (3)	Fluoroscopy (2)	√ (2) ~ (1)	Moderate to strong I	😐
	Without specification (1)	n.r.	X (1, do not offer)	n.r.	☺

Synopsis of recommendation:
Inconsistent *↑↑ (for use) or ↑? (for use) and ↓↓ (against use) and ~ (neither in supports nor against)*

Abbreviations: CG: clinical guideline; GoR: Grade of recommendation; n.r.: not reported

Symbols: √ recommendations in support; X recommendations against; ~ recommendations neither in support nor against

☺ *High quality;* 😐 *Moderate quality;* ☹ *Low quality*

The details for each guideline, with original recommendations, are presented in Table 3-3 below.

Table 3-3: Clinical guidelines recommendations for use of image-guided epidural injections (with local anaesthetic and/or steroids) in treatment of chronic spinal pain, indication: Axial discogenic pain

Society or Institution/Reference	Year	Country	Quality of guideline	Spinal area/Image-guided technology	Recommendations	LoE	GoR
American Society of Interventional Pain Physicians (ASIPP) [6]	**2021**	**US**	**Moderate**	Cervical, lumbar/ Fluoroscopy	The evidence for axial discogenic pain without facet joint pain or sacroiliac joint pain in the lumbar and cervical spine with fluoroscopically guided *caudal, lumbar interlaminar and cervical interlaminar* epidural injections, based on one relevant high quality RCT in each category is **Level II** with **moderate to strong recommendation** for long-term improvement, with or without steroids.	**II**	**Moderate to strong**
American Society of Pain and Neuroscience (ASPN) [14]	**2022**	**US**	**Moderate**	Lumbar/n.r.	*Interlaminar* epidural injections for treatment of low back pain originating from disc disease	**I-A, High level of certainty**	**A**
					Transforaminal epidural injections for treatment of low back pain originating from disc disease	**I-A, High level of certainty**	**A**
					Caudal epidural injections for treatment of low back pain originating from disc disease when interlaminar or transforaminal approaches are not feasible	**I-A, High level of certainty**	**A**
					Use of **either steroid or local anaesthetic or the two classes of medication in combination** for use in epidural injections for treatment of low pain originating from disc disease	**I-A, High level of certainty**	**A**
North American Spine Society (NASS) [29]	**2020**	**US**	**Moderate**	Lumbar/fluoroscopy			
					There is **insufficient evidence** to make a **recommendation for or against** the use of interlaminar epidural **steroid injections** in patients with low back pain.	**Insufficient or conflicting**	**I**
					There is **insufficient evidence** to make a recommendation **for or against** the use of caudal epidural **steroid injections** in patients with low back pain.	**Insufficient or conflicting**	**I**
NICE [15]	**2020**	**UK**	**High**	Lumbar	**Do not** offer **spinal injections** for managing **low back pain. [2016]**	NA	NA

Abbreviations: LoE: Level of evidence; GoR: Grade of recommendation; NA: not available; n.r.: not reported; NICE: National Institute for Health and Excellence; US: United States; UK: United Kingdom

Indication: Disc herniation

Bandscheibenvorfall:

Four CGs addressed epidural injections for disc herniation [6] [14, 15, 26]. One is related to the cervical spine, one to the thoracic spine, and four CGs on the lumbar spine (Table 3-4).

In summary, only one CG was related to the cervical spine and provided strong recommendations for cervical interlaminar epidural injections. The same is true for the thoracic spine, with moderate to strong recommendations for interlaminar epidural injections.

4 Leitlinien:

konsistente Empfehlungen für die Verwendung von epiduraler Injektionen

Fluoroskopie als bildgebenedes Verfahren

Within four CGs which provided recommendations on the lumbar spine, two CGs were related to interlaminar, transforaminal and caudal access mode, with strong recommendations on such interventions, and two CGs did not specify the access mode. These two CGs provided weak recommendations for the intervention. If stated (two guidelines), the imaging technology was fluoroscopy. One of the CGs, AWMF S2K 2020 guideline, when reflecting specifically on CT vs. fluoroscopy, pointed out that CT interventions are widespread in German-speaking countries, in contrast to injections under fluoroscopy, and it consequently states the following: If a method is at least equivalent with lower radiation exposure (in this case, fluoroscopy is even superior), then this method (i.e., fluoroscopy) must be given preference over the other method (CT) [26]. All except one CG are of moderate quality. Overall, there are both strong and weak recommendations for using epidural injections for disc herniation (Table 3-4 below) across guidelines.

*Table 3-4: Summary of recommendations: **Epidural injections in Disc herniation***

Spine level/ No of CGs	Access mode (No of CGs)	Imaging technology (No of CGs)	Recommendation (No of CGs)	GoR	Quality of CGs
Cervical					
1	Interlaminar (1)	Fluoroscopy (1)	√ (1)	Strong	😐
Thoracic					
1	Interlaminar (1)	Fluoroscopy (1)	√ (1)	Moderate to strong	😐
Lumbar					
4	Interlaminar (2)	Fluoroscopy (1)	√ (2)	Strong; A	😐
	Transforaminal (2)	Fluoroscopy (1)	√ (2)	Strong; A	😐
	Caudal (2)	Fluoroscopy (1)	√ (2)	Strong; A	😐
	Without specification (2)	Fluoroscopy (1)	√ (2, "consider" and "can be")	n.r. n.r. (71%-100% consensus)	😊 😐

Synopsis of recommendation: Strong ↑↑ and weak ↑? for using an intervention

Abbreviations: CG: clinical guideline; GoR: Grade of recommendation; n.r.: not reported

Symbols: √ recommendations in support; X recommendations against; ~ recommendations neither in support nor against

😊 High quality; 😐 Moderate quality; ☹ Low quality

Strong recommendation for using an intervention ↑↑

Weak recommendation for using an intervention ↑?

The details for each guideline, with original recommendations, are presented in Table 3-5 below.

Table 3-5: Clinical guidelines recommendations for use of image-guided epidural injections (with local anaesthetic and/or steroids) in the treatment of chronic spinal pain, indication: Disc herniation

Society or Institution/Reference	Year	Country/ies	Quality of guideline	Spinal area/Image-guided technology	Recommendations	LoE	GoR
American Society of Interventional Pain Physicians (ASIPP) [6]	**2021**	**US**	**Moderate**	Whole spine/fluoroscopy			
				Cervical	Based on relevant, moderate to high-quality fluoroscopically guided epidural injections, with or without steroids RCTs, and results of previous systematic reviews, the evidence is **Level I** for *cervical interlaminar* epidural injections with **strong recommendation** for long-term effectiveness.	**I**	**Strong**
				Thoracic	For thoracic disc herniation, based on one relevant, high-quality RCT of thoracic interlaminar epidural with fluoroscopic guidance, with or without steroids, the evidence is **Level II** with **moderate to strong recommendation** for long-term effectiveness.	**II**	**Moderate to strong**
				Lumbar	Based on relevant, moderate to high-quality fluoroscopically guided epidural injections, with or without steroids, and results of previous systematic reviews, the evidence is **Level I** for *caudal* epidural injections, *lumbar interlaminar* epidural injections, *lumbar transforaminal* epidural injections, with **strong recommendation** for long-term effectiveness.	**I**	**Strong**
American Society of Pain and Neuroscience (ASPN) [14]	**2022**	**US**	**Moderate**	Lumbar/n.r.	Interlaminar epidural injections for treatment of radicular pain originating from disc disease	**I-A, High certainty**	**A**
					Transforaminal epidural injections for treatment of radicular pain originating from disc disease	**I-A, High level of certainty**	**A**
					Caudal epidural injections for treatment of radicular pain originating from disc disease when interlaminar or transforaminal approaches are not feasible	**I-A, High level of certainty**	**A**
					Use of either steroid or local anaesthetic or the two classes of medication in combination	**I-A, High level of certainty**	**A**
NICE [15]	**2020**	**UK**	**High**	Lumbar/n.r.	**Consider epidural injections** of **local anaesthetic and steroid** in people with **acute and severe sciatica. [2016]**	NA	NA
AWMF [26]	**2020**	**Germany**	**Moderate**	Lumbar/fluoroscopy	*Subacute* radicular symptoms Interventional treatment ***can be*** carried out in the case of *subacute* radicular symptoms in the lumbar spine.	NA	100% agree consensus 4 abstentions
					Risk of chronic pain **Interventional therapy can also be carried out in the case of pain that is at risk of chronic pain.**	**NA**	**71% agree consensus** **4 abstentions**

Abbreviations: AWMF: German Society for Orthopedics and Orthopedic Surgery (DGOOC), Spine Section of the German Society for Orthopedics and Trauma Surgery (DGOU), German Society for Neurosurgery (DGNC) and German Spine Society (DWG); LoE: Level of evidence; GoR: Grade of recommendation; NA: not available; n.r.: not reported; NICE: National Institute for Health and Excellence; US: United States; UK: United Kingdom

Indication: Spinal stenosis

Spinalkanalstenosen:

Five CGs addressed epidural injections in spinal stenosis [6] [14, 15, 27, 28]. Only one is related to the cervical spine, none to the thoracic spine, and five CGs on the lumbar spine (Table 3-6). In summary, only one CG was related to the cervical spine and provided moderate to strong recommendations for cervical interlaminar epidural injections.

5 Leitlinien mit widersprüchlichen Empfehlungen beim Lendenwirbelbereich

Fluoroskopie als bildgebenedes Verfahren

Within five CGs which provided recommendations on the lumbar spine, two CGs were related to interlaminar, transforaminal and caudal access modes, with moderate to strong recommendations for such interventions. Three CGs did not specify access mode. One of these CGs provided weak recommendations for using the intervention, and two CGs provided recommendations against the use of this intervention. Where mentioned (one CG), fluoroscopy was the recommended imaging technology. Two CGs are high-quality guidelines, two are moderate quality, and one is low quality. The high-quality guidelines are those with recommendations against the intervention. Overall, the recommendations are inconsistent regarding epidural injections in spinal stenosis, with conflicting recommendations across CGs ("in support" or "against" (Table 3-6 below).

Table 3-6: Summary of recommendations: ***Epidural injections in Spinal stenosis***

Spine level/ No of CGs	Access mode (No of CGs)	Imaging technology (No of CGs)	Recommendation (No of CGs)	GoR	Quality of CGs
Cervical					
1	Interlaminar (1)	Fluoroscopy (1)	√ (1)	Moderate to strong	😐
Thoracic					
n.r.	n.r.	n.r.	n.r.	/	/
Lumbar					
5	Interlaminar (2)	Fluoroscopy (1)	√ (2)	Moderate to strong; A	😐
	Transforaminal (2)	Fluoroscopy (1)	√ (2)	Moderate; A	😐
	Caudal (2)	Fluoroscopy (1)	√ (2)	Moderate to strong; A	😐
	Without specification (3)	n.r.	√ (1) X (2, "do not use")	B Conditional/Weak n.r.	☹ ☺ ☺

Synopsis of recommendation: ***Inconsistent*** *↑↑ (for use) or ↑? (for use) and ↓↓ (against use) or ↓? (against use)*

Abbreviations: CG: clinical guideline; GoR: Grade of recommendation; n.r.: not reported

Symbols: √ recommendations in support; X recommendations against; ~ recommendations neither in support nor against

☺ *High quality;* 😐 *Moderate quality;* ☹ *Low quality*

The details for each guideline, with original recommendations, are presented in Table 3-7 below.

Table 3-7: Clinical guidelines recommendations for use of image-guided epidural injections (with local anaesthetic and/or steroids) in treatment of chronic spinal pain, indication: Spinal stenosis

Society or Institution/ Reference	Year	Country/ies	Quality of guideline	Spinal area/Image-guided technology	Recommendations	LoE	GoR
American Society of Interventional Pain Physicians (ASIPP) [6]	**2021**	**US**	**Moderate**	Cervical/Fluoroscopy	**Level II** for fluoroscopically guided cervical *interlaminar* epidural injections with **moderate to strong recommendation** for long-term effectiveness.	**II**	**Moderate to strong**
				Lumbar/Fluoroscopy	**Level II** for fluoroscopically guided lumbar *interlaminar* epidural injections with **moderate to strong recommendation** for long-term effectiveness.	**II**	**Moderate to strong**
					The **evidence** for **lumbar transforaminal** epidural injections is **Level IV to III** with **moderate recommendation** with fluoroscopically guided lumbar transforaminal epidural injections for long-term improvement.	**IV to III**	**Moderate**
					The evidence based on one high-quality RCT in each category the **evidence** is **Level III to II** for fluoroscopically guided caudal epidural injections with **moderate to strong recommendation** for long-term improvement	**III to II**	**Moderate to strong**
American Society of Pain and Neuroscience (ASPN) [14]	**2022**	**US**	**Moderate**	Lumbar/n.r.	***Interlaminar*** epidural injections for treatment of spinal stenosis	**I-A, High certainty**	**A**
					Transforaminal epidural injections for treatment of spinal stenosis	**I-A, High level of certainty**	**A**
					***Caudal* epidural** injections for treatment of spinal stenosis when interlaminar or transforaminal approaches are not feasible	**I-A, High level of certainty**	**A**
					Use of **either steroid or local anaesthetic or the two classes of medication in combination**	**I-A, High level of certainty**	**A**
American Society of Pain and Neuroscience (ASPN) [27]	**2022**	**US**	**Low**	Lumbar/n.r.	Epidural **steroid injections** are **recommended** in the algorithm for the treatment of symptomatic lumbar spinal stenosis.	**I-A; Level of certainty high**	**B**
					Epidural steroid injection may be repeated when a patient has significant temporary improvement in symptoms. Be aware that the number and frequency of injections may be limited by insurance and payer rules and regulations.	**I-B; Level of certainty moderate**	**B**
US Association for the Study of Pain (USASP) [28]	**2021**	**US**	**High**	Lumbar/n.r.	For patients with LSS and neurogenic claudication with or without LBP, we **do not suggest** the use of epidural steroidal injections for short term reduction in pain and improved function	**High**	**Conditional/ Weak**
NICE [15]	**2020**	**UK**	**High**	Lumbar/n.r.	**Do not use** epidural injections for neurogenic claudication in people who have central spinal canal stenosis. [2016]	NA	NA

Abbreviations: LoE: Level of evidence; GoR: Grade of recommendation; NA: not available; n.r.: not reported; NICE: National Institute for Health and Excellence; US: United States; UK: United Kingdom

Indication: Post-surgery syndrome

postoperatives Syndrom:

Three CGs addressed epidural injections in post-surgery syndrome [6] [14, 26]. Only one is related to the cervical spine, none to the thoracic spine, and three CGs to the lumbar spine (Table 3-8). In summary, only one CG related to the cervical spine provided moderate to strong recommendations for cervical interlaminar epidural injections.

3 Leitlinien mit konsistenten Empfehlungen für die Verwendung von epiduralen Injektionen mit Fluoroskopie

Within three CGs which provided recommendations on the lumbar spine, one CG was related to interlaminar, two CGs to transforaminal and two CGs to a caudal access mode, with a mixture of strong and weak recommendations for such interventions. The imaging technology is mentioned in two CGs, all pointing to fluoroscopy as the recommended technology. All CGs are of moderate quality. Overall, CGs consistently favour using epidural injections in post-surgery syndrome, with different grades of recommendations ranging from weak to strong (Table 3-8 below).

Table 3-8: Summary of recommendations: ***Epidural injections in Post-surgery syndrome***

Spine level/ No of CGs	Access mode (No of CGs)	Imaging technology (No of CGs)	Recommendation (No of CGs)	GoR	Quality of CGs
Cervical					
1	Interlaminar (1)	Fluoroscopy (1)	√ (1)	Moderate to strong	😐
Thoracic					
n.r.	n.r.	n.r.	n.r.	/	/
Lumbar					
3	Interlaminar (1)	n.r.	√ (1)	A	😐
	Transforaminal (2)	Fluoroscopy (1)	√ (2, "can be")	A n.r. (93% consensus)	😐
	Caudal (2)	Fluoroscopy (1)	√ (2)	Moderate to strong; A	😐

Synopsis of recommendation: Strong ↑↑ and weak ↑? for using an intervention

Abbreviations: CG: clinical guideline; GoR: Grade of recommendation; n.r.: not reported

Symbols: √ recommendations in support; X recommendations against; ~ recommendations neither in support nor against

☺ High quality; 😐 Moderate quality; ☹ Low quality

Strong recommendation for using an intervention ↑↑; Weak recommendation for using an intervention ↑?

The details for each guideline, with original recommendations, are presented in Table 3-9 below.

Table 3-9: Clinical guidelines recommendations for use of image-guided epidural injections (with local anaesthetic and/or steroids) in treatment of chronic spinal pain, indication: Post-surgery syndrome

Society or Institution/ Reference	Year	Country/ies	Quality of guideline	Spinal area/Image-guided technology	Recommendations	LoE	GoR
American Society of Interventional Pain Physicians (ASIPP) [6]	**2021**	**US**	**Moderate**	**Fluoroscopy**			
				Cervical/ Fluoroscopy	The evidence for cervical post-surgery syndrome based on one relevant, high-quality RCT with fluoroscopic guidance for cervical *interlaminar* epidural injections, with or without steroids, is **Level II to I with moderate to strong recommendation** for long-term improvement.	**II to I**	**Moderate to strong**
				Lumbar/ Fluoroscopy	The evidence for caudal post-surgery syndrome based on one relevant, high-quality RCT with fluoroscopic guidance for caudal epidural injections, with or without steroids, is **Level II with moderate to strong recommendation** for long-term improvement.	**II**	**Moderate to strong**
American Society of Pain and Neuroscience (ASPN) [14]	**2022**	**US**	**Moderate**	Lumbar/n.r.	***Interlaminar*** epidural injections for treatment of chronic back/leg pain after surgical intervention	**I-A, High certainty**	**A**
					Transforaminal epidural injections for treatment for treatment of chronic back/leg pain after surgical intervention	**I-A, High level of certainty**	**A**
					***Caudal* epidural** injections for treatment for treatment of chronic back/leg pain after surgical intervention when interlaminar or transforaminal approaches are not feasible	**I-A, High level of certainty**	**A**
					Use of **either steroid or local anaesthetic or the two classes of medication in combination**	**I-A, High level of certainty**	**A**
AWMF [26]	**2020**	**Germany**	**Moderate**	Lumbar/ Fluoroscopy	*Postoperative* treatment of radicular symptoms Interventional pain therapy *can be used* for postoperative treatment of radicular symptoms.	NA	87% agree consensus 3 abstentions
					Postoperative treatment of radicular symptoms In the event of postoperative radicular symptoms, *transforaminal injections can be* made to the lumbar spine.	NA	93% agree consensus 4 abstentions

Abbreviations: AWMF: German Society for Orthopedics and Orthopedic Surgery (DGOOC), Spine Section of the German Society for Orthopedics and Trauma Surgery (DGOU), German Society for Neurosurgery (DGNC) and German Spine Society (DWG); LoE: Level of evidence; GoR: Grade of recommendation; NA: not available; n.r.: not reported; US: United States; UK: United Kingdom

3.2.2 Facet joint injections (with local anaesthetic and/or steroids)

Indication: Axial facet joint pain

axiale Facettengelenksschmerzen:

Five CGs addressed facet joint injections (nerve block and intraarticular injections) in axial facet joint pain [12] [14, 29] [30] [31]. Two are related to the cervical spine, one to the thoracic spine, and four CGs concern the lumbar spine. In summary, two CGs related to the cervical spine provided conflicting recommendations for nerve block and intraarticular injections. Only one CG is related to the thoracic spine, with weak to moderate recommendations in favour of the intervention.

5 Leitlinien und insg. uneindeutige Empfehlungen

Fuoroskopie oder CT als Bildgebung

Within four CGs that provided recommendations on the lumbar spine, conflicting recommendations were provided for nerve block and intraarticular injections. Within two CGs in favour of nerve block injections, one stated that such intervention is prognostic for radiofrequency ablation (RFA) procedure. Within two CGs against intraarticular injections, one CG pointed out that this intervention does not replace or delay RFA, and the other is against routine use. One is neither in support nor against the intervention. Regarding imaging technology, almost all CGs recommended fluoroscopic or computed tomography (CT) guidance for all facet joint interventions. One low-quality CG related to the cervical spine recommends fluoroscopy or US in the cervical spine for nerve block and fluoroscopy or CT-fluoroscopy for intraarticular injections [31]. Four CGs are of moderate quality, and one is of low quality. Overall, the recommendation is inconsistent regarding facet joint injections (nerve block and intraarticular injections), with conflicting recommendations across CGs ("in support" or "against" or "neither in support nor against" (Table 3-10 below).

Table 3-10: Summary of recommendations: ***Facet joint injections (nerve block and intraarticular) in Axial facet joint pain***

Spine level/ No of CGs	Access mode (No of CGs)	Imaging technology (No of CGs)	Recommendation (No of CGs)	GoR	Quality of CGs
Cervical					
2	Nerve block (2)	Fluoroscopy or CT (1) Fluoroscopy or ultrasound (1)	√ (1) X (1, routine use should be avoided)	Moderate D	😐 ☹
2	Intraarticular (2)	Fluoroscopy or CT (1) Fluoroscopy or CT-fluoroscopy (1)	√ (1) X (1, against the routine use)	Weak C	😐 ☹
Thoracic					
1	Nerve block (1)	Fluoroscopy or CT (1)	√ (1)	Moderate	😐
1	Intraarticular (1)	Fluoroscopy or CT (1)	√ (1)	Weak to moderate	😐
Lumbar					
4	Nerve block (4)	Fluoroscopy or CT (2) Image-guided technology not-specified (1) n.r. (1)	√ (2) X (1, against the routine use) n.r. (1)	Moderate A (Prognostic for RFA) D	😐 😐 😐
	Intraarticular (4)	Fluoroscopy or CT (2) Image-guided technology not-specified (1) Fluoroscopy (1)	√ (1) X (1, do not replace or delay RFA) ~ (1) X (1, against the routine use)	Weak C I D	😐 😐 😐 😐

Synopsis of recommendation: ***Inconsistent*** *↑? (for use) and ↓↓ (against use) and ~ (neither in supports nor against)*

Abbreviations: CG: clinical guideline; GoR: Grade of recommendation; n.r.: not reported

Symbols: √ recommendations in support; X recommendations against; ~ recommendations neither in support nor against

☺ *High quality;* 😐 *Moderate quality;* ☹ *Low quality*

The details for each guideline, with original recommendations, are presented in Table 3-11 below.

Table 3-11: Clinical guidelines recommendations for use of image-guided facet joint injections (with local anaesthetic and/or steroids) in treatment of chronic spinal pain, indication: Axial facet joint pain

Society or Institution/ Reference	Year	Country/ies	Quality of guideline	Spinal area/Image-guided technology	Recommendations	LoE	GoR
American Society of Interventional Pain Physicians (ASIPP) [12]	**2020**	**US**	**Moderate**	**Whole spine/fluoroscopic or computed tomography (CT)**	The **level of evidence** is **I** with **strong strength of recommendation**, for ***mandatory* fluoroscopic or computed tomography (CT) guidance** for all facet joint interventions.	**I**	**Strong**
				Cervical	The **level of evidence** is **II** with **moderate strength of recommendation** for therapeutic *cervical facet joint nerve blocks* with inclusion of one relevant randomized controlled trial and 3 observational studies, with long-term improvement.	**II**	**Moderate**
					The **level of evidence** is **V** with **weak strength of recommendation** for cervical *intraarticular facet joint injections* with inclusion of 3 relevant randomized controlled trials, with 2 observational studies, the majority showing lack of effectiveness, whereas one study with 6-month follow-up, showed lack of long-term improvement.	**V**	**Weak**
				Thoracic	The **level of evidence** is **II** with **moderate strength of recommendation** for thoracic therapeutic *facet joint nerve blocks* with inclusion of 2 randomized controlled trials and 2 observational studies with long-term improvement	**II**	**Moderate**
					The **level of evidence** is **III** with **weak to moderate strength of recommendation** for thoracic *intraarticular facet joint injections* with inclusion of one randomized controlled trial with 6-month follow-up, with emerging evidence.	**III**	**Weak to moderate**
				Lumbar	The **level of evidence** is **II** with **moderate strength of recommendation** for therapeutic *lumbar facet joint nerve blocks* with inclusion of 3 relevant randomized controlled trials, with long-term improvement.	**II**	**Moderate**
					The **level of evidence** is **IV** with **weak strength of recommendation** for *lumbar facet joint intraarticular injections* with inclusion of 9 relevant randomized controlled trials, with majority of them showing lack of effectiveness without the use of local anaesthetic.	**IV**	**Weak**
American Society of Pain and Neuroscience (ASPN) [14]	**2022**	**US**	**Moderate**	Lumbar/n.r.	**Intra-articular facet steroid injections do not replace or delay** the need for **radiofrequency ablation (RFA)**	**I-A, Level of certainty – Strong**	**C**
					Intra-articular facet steroid injections can be prognostic for RFA	**I-A, Level of certainty – Strong**	**C**
					Image guided facet steroid injections are **more effective than blind injections**	**I-A, Level of certainty – Strong**	**A**
					Do not use intra-articular facet joint steroid injections as sole therapy for facet-mediated pain	**I-A, Level of certainty – Strong**	**B**
					Lumbar Medial Branch Blocks can be prognostic for RFA	**I-A, Level of certainty – Strong**	**A**

Society or Institution/ Reference	Year	Country/ies	Quality of guideline	Spinal area/Image-guided technology	Recommendations	LoE	GoR
North American Spine Society (NASS) [29]	**2020**	**US**	**Moderate**	Lumbar/ Fluoroscopy	There is **insufficient evidence** to make a recommendation **for or against** the use of steroid injections into the **zygapophyseal joint** in patients with chronic back pain and a physical exam suggestive of facet-mediated pain.	**Insufficient or conflicting**	**I**
International working group (IWG) [30]	**2020**	**International working group**	**Moderate**	Lumbar/CT or fluoroscopy	**Therapeutic benefit from MBB and IA injections**: We recommend **against the routine use of therapeutic facet injections**, although we acknowledge that in patients who may be at risk of adverse consequences from RFA (eg, young athletes, older individuals on anticoagulation therapy or with implantable cardiac devices) or in whom there is a strong likelihood of success (eg, individuals who obtained prolonged relief from previous diagnostic injections with or without steroids), it may reasonable to add steroids to a block in the hope of deriving intermediate-term relief; grade D, moderate level of certainty.	**Moderate**	**D**
					We recommend that **CT or preferably fluoroscopy** (lower costs, faster time and less radiation exposure than CT) be used for **lumbar MBB**, although ultrasound may be useful in patients in whom radiation exposure may be associated with potential harm (eg, pregnant), or in patients without obesity when radiographic or radiological imaging is unavailable; grade B recommendation, moderate level of certainty.	**Moderate**	**B**
					For **IA injections**, we recommend the use of **CT scanning** to enhance accuracy, although fluoroscopy using contrast injection to confirm IA placement can also be considered in certain cases (eg, a thin person without minimal joint narrowing) given the lower costs and radiation exposure; grade C recommendation, low level of certainty.	**Low**	**C**
International working group (IWG) [31]	**2022**	**International working group**	**Low**	Cervical/Fluoroscopy (or US for MBB)	We recommend **against the routine use of IA injections**, although we acknowledge that in patients who may be at risk of adverse consequences from RFA (eg, young athletes, older individuals on anticoagulation therapy, or with implantable cardiac devices) in whom there is a strong likelihood of success (eg, individuals who obtained prolonged relief from previous diagnostic injections with or without steroids), and/or patients who do not have readily available access to cervical medial branch RFA, it may be reasonable to consider IA facet joint injections with steroid (non-particulate at C2-3) in the hope of deriving intermediate-term relief; **grade C**, low-to-moderate level of certainty.	**Low-moderate**	**C**
					We recommend that **fluoroscopy or (in providers with expertise) US** be used for **cervical MBB**. US can be useful in patients in whom radiation exposure may be associated with potential harm; however, the lack of training may limit widespread adoption; **Grade A recommendation**, moderate level of certainty.	**Moderate**	**A**
					For **IA injections**, we recommend the use of **fluoroscopic imaging** as the additional radiation exposure from CT compared with fluoroscopy precludes any theoretical benefit; **Grade C recommendation**, low level of certainty.	**Low**	**C**
					Whereas **CT-fluoroscopy** is associated with less radiation than CT alone, it is not widely available and adds significant upfront equipment costs and radiation exposure; **Grade A recommendation**, high level of certainty for the use of imaging,	**High**	**A**

Society or Institution/ Reference	Year	Country/ies	Quality of guideline	Spinal area/Image-guided technology	Recommendations	LoE	GoR
International working group (IWG) [31] *(continuation)*					**Grade B recommendation**, moderate level of certainty for the use of **fluoroscopy instead of other imaging modalities**.	**Moderate**	**B**
					Optimal technique for Atlanto-occipital (AO) (C0-1) and Atlanto-axial (AA) (C1-2) joint injections and risk mitigation: **Advanced imaging** should **be obtained** before injections; **Grade C, low level of certainty**.	**Low**	**C**
					When performing AO and AA joint injections, we recommend a posterior approach with confirmation of IA spread **using real-time fluoroscopy or DSA** in both anteroposterior and lateral views; **Grade B, moderate level of certainty**.	**Moderate**	**B**
					There is **insufficient evidence** regarding the use of **CT guidance or US guidance without fluoroscopy** when performing AO and AA injections; Grade I recommendation.		**I**
					There is a small body of evidence that the use of steroids in AO and AA joint injections may be beneficial in selected populations; however, the magnitude of benefit is small; **Grade C recommendation**, low level of certainty. Based on indirect evidence, we recommend that, if steroids are administered, <1 mL of non-particulate steroids be administered; Grade C recommendation, low-to-moderate level of certainty.	**Low**	**C**
					Approach for cervical MBB: For logistical reasons that vary by level and patient, and to optimize safety, we recommend consideration of a fluoroscopically-guided lateral approach for **third occipital nerve** (TON) and C3-C7 MBB, but a fluoroscopically-guided posterior or posterior oblique approach for C8 MBB.		**I**
					Given the lack of a pathophysiological basis for prolonged relief and the known risks of steroids, the **routine use of steroids with cervical MBB** should be **avoided**; **grade D recommendation**, moderate level of certainty.	**Moderate**	**D**

Abbreviations: AO: Atlanto-occipital; AA: Atlanto-axial; LoE: Level of evidence; GoR: Grade of recommendation; IA: intraarticular; MBA: medial branch block; NA: not available; n.r.: not reported; RFA: radiofrequency ablation; TON: third occipital nerve; US: United States; UK: United Kingdom

3.3 Organisational aspects

Non-systematic literature search and hand search resulted in twenty-five references with different study designs relevant to organisational aspects.

identifizierte organisationale Aspekte:

Healthcare settings and patient/participant flow

Setting

Multiple specialities perform image-guided injections, including spine and pain management specialists, such as physiatrists, anaesthesiologists, radiologists, neurologists, and spine surgeons.

möglicherweise ökonomische und organisatorische Vorteile im ambulanten Setting

If fluoroscopy is used as imaging technology, these procedures can be performed in the outpatient setting without sedation. Alternatively, they can be performed with a short recovery time in a hospital-based interventional fluoroscopic suite with a rotating plane. The latter is usually the setting where radiologists perform these procedures [32, 33].

Literature data showed that shifting spine interventional pain injections from a hospital-based setting to a clinic-based outpatient setting could result in decreased procedural, fluoroscopic, and wait times as well as a substantial decrease in health system costs [32].

Other technologies mentioned (e.g., ultrasound, CT, CT-fluoroscopy) also allow performing the intervention in both settings.

Variation in practice related to spinal injections and image-guided technologies

Variation der Behandlungspraxis hinsichtlich der Zugriffsart, ...

Published literature shows that there continue to be variations in epidural steroid injection (ESI) practice regarding the choice of access mode and image-guided technologies, methods to detect intravascular uptake, choice of injectate, and the use of particulate steroids for transforaminal epidural steroid injection (TFESI). Such variations deviate from clinical guidelines [34-36].

... der Häufigkeit der Anwendung und ...

Authors from the UK pointed out that intraarticular facet joint injections are still widely used despite the lack of support by UK and US guidelines and a lack of evidence. Low-quality evidence supports using medial branch blocks for the long-term management of low back pain, and poor evidence supports repeat injections (MBB and FJI). Despite that, the getting it right first time (GIRFT) data show a high degree of variation in the use of multiple injections, which would not appear to be supported by the literature [36].

... der Leistungserbringer

Literature also shows heterogeneity in the image-guided technologies used to perform spinal interventional pain procedures. While image-guided spinal injections are regarded as superior (reaching the correct anatomical target, documenting the needle placement and contrast distribution, allowing the identification of inadvertent punctures and the subsequent correction of the needle position) [37-39], there was variation in the past. In a 2002 survey in the US related to the use of fluoroscopy for ESI in private practices and academic anaesthesia programs, private practices used significantly more fluoroscopy than academic centres (93% vs 69%). Large differences were found in lumbar and cervical ESI (for lumbar ESI, 77% in private practice groups vs academic centres, 38%; for cervical ESI, 73% vs 39% respectively) [40].

Conversely, in a recent cross-sectional survey of pain medicine physicians in the United States, all but one responder used fluoroscopy for lumbar ESI [34].

Verfügbarkeit der Geräte trägt wesentlich zur Entscheidung spezifischer Bildgebungstechnologien bei

Several factors may influence the decision on which image modality to use for nerve root blocks or epidural injections, like the availability of examination slots in the CT unit or fluoroscopy unit, considerations about safety and radiation dose, or preference by the interventionalist or the referring physician [41-46]. For example, the use of CT guidance for spinal interventional pain procedures is largely guided by physician preference and ease of access to specific imaging modalities [47] [48]. One study published in 2021 [48] pointed out that fluoroscopy and CT guidance are both used to direct needle placement in spinal injections. If utilizing CT for guidance, the CT unit should ideally be capable of a CT fluoroscopy mode that greatly reduces the dose versus conventional CT. In summary, the desired modality needs to be based on the procedure, personal experience, patient factors, and resource availability.

Radiation dose as a cause of variation in using different image-guided technologies

Strahlenbelastung

CT scheint geringere Strahlenbelastung für Patient:innen aufzuweisen

When choosing the imaging modality for spinal injections, radiation dose is important [17]. CT guidance carries a higher radiation dose to both patients and proceduralists, reported 1.4 times higher than traditional fluoroscopy for transforaminal lumbar epidural steroid injection and 3.3 times higher on lumbar facet injections, although with no significant difference in patient outcomes. Intermittent CT fluoroscopy with very low doses can be used, leading to a slightly reduced image quality with more noise, but still adequate for needle placement and visualization of the injected contrast fluid. In contrast to conventional CT, where the operator is protected behind the lead screen of the console, CTF procedures require the presence of the staff in the examination room during CT scanning. As a result, the operator is exposed to an intense scatter radiation field [49].

Fluoroskopie scheint dafür höhere Strahlenbelastung für Kliniker:innen aufzuweisen

Some authors found that while the effective radiation dose in fluoroscopy-guided injections was lower for the patients, for the treating physicians, the radiation dose with fluoroscopy was substantially higher than with CT [50] [51]. Based on these data, the authors decided to use CT as the primary modality for spine interventions and to optimize the CT protocols further to reduce the patient's radiation exposure.

Ultraschall ohne Strahlenbelastung, jedoch schlechtere Sicht

To completely avoid radiation, some authors pointed out that facet joint injections can be done under ultrasound guidance with equivalent efficacy to fluoroscopic guidance [18]. However, obese patients may present a challenge for ultrasound guidance due to poor visualization of deep anatomical structures. Also, some ultrasound-guided techniques remain challenging or impractical. For certain interventions (thoracic facet joint), literature is lacking to inform practice [52].

Further research is required to understand the exact role of ultrasound in image-guided injections [53]. This is specifically true for cervical spine procedures, as precise recognition of the shape of the cervical vertebrae, neck muscles, and cervical neurovascular vital structures is essential for a secure and effective procedure [54].

Quality of care and monitoring system

Qualität der Versorgung und Monitoring:

Vorsichtsmaßnahmen bezüglich der Sicherheit interventioneller Prozeduren

The French National Societies (Societe d'imagerie musculosquelettique (SIMS), Federation de radiologie interventionnelle (FRI), and Societe francaise de radiologie (SFR)) in 2018 [55] pointed to the need to ensure that all usual precautions be taken regarding information and safety for all interventional procedures, specifically: verification of the good basis of the indication; verification of the presence or absence of surgical history in the region of the treatment site; delivery of information to patients, particularly concerning the risks of neurological complications and obtention of written informed consent; infiltration guidance using fluoroscopy, scanner, or cone beam CT; optimization of needle positioning; use of a non-ionic contrast products to verify the absence of arterial catheterization (which does not necessarily eliminate the risk prior to injection of corticosteroids).

prozedurale Dokumentation und Monitoring-Systeme,

Published literature highlighted the importance of proper documentation of interventional procedures, including evaluation and management services, procedural services, and billing and coding. The purpose of documentation is to provide information, but it also reflects the competency and character of the physician [6] [12]. Procedural documentation guidelines for interventional techniques related to epidural injections and facet-joint injections are those noted in the standards provided below.

um Sicherheit zu gewährleisten

To assure quality, a monitoring system with standards and indicators is needed. Different institutions provided clinical standards of good practice for spinal interventional procedures in pain medicine [56, 57] [58].

Standards von Fachgesellschaften

In Europe, the British Pain Society and the Faculty of Pain Medicine of the Royal College of Anaesthetists, 2020 [56] and the Faculty of Pain Medicine (FPM) from the UK, 2021 [58] provided standards of good practice for spinal interventional procedures in pain medicine. Standards are related to environment and facilities, assistance, fluoroscopy, record keeping and follow-up and discharge planning. In Australia and New Zeeland, Faculty of Pain Medicine (FPM) and the Australian and New Zeeland College of Anaesthetists (ANZCA), 2020 [57] provided clinical care standards related to the care of adult patients (aged 18 years and older) undergoing procedures for the diagnosis or treatment of cancer-related or chronic non-cancer pain, with the aim to articulate what is considered to be the appropriate and safe use of procedures in the practice of pain medicine. These standards are summarized below.

Environment and facilities

Umwelt und Einrichtungen

Spinal interventions should be performed aseptically in an appropriate environment that adheres to local guidelines with regard to minimally invasive procedures. Infection prevention and control, monitoring, imaging and availability of assistance should all adhere to local policies and National guidelines. The clinical area should be of adequate size in order to accommodate the staff and equipment necessary for safe, minimally invasive procedure practice. The clinical area should have a fully equipped and staffed post anaesthesia care facility in close proximity. Resuscitation equipment, trained staff and facilities must be immediately available should this be required.

Assistance

Assistenz durch verschiedenste Berufsgruppen

The assistance should be available to ensure that the procedure can be carried out safely and with enough support in case of emergency.

There are no specific guidelines or recommendations, but the following should be considered:

- *Presence of Radiographer:* It is legally applied and usual practice in the UK to have a radiographer in charge of the imaging system, though the practitioner may control and move the 'C-arm'. Assistant to the practitioner: Skilled Assistance to the practitioner should be available to check and prepare pharmaceuticals for epidural and facet joint injections in a safe and sterile manner.
- *Monitoring of the patient:* This should be undertaken by a further attendant who does not have other responsibilities. This becomes more important for longer procedures where continuous observation and regular recording of vital signs is essential. It is recognised that in some (shorter) cases, this may be the same assistant who initially helps the practitioner draw up the drugs.
- *Skill level:* The assistant (s) should be skilled in Immediate Life Support (ILS) (Resuscitation Council UK). All assistance should come from appropriately trained nursing or theatre staff. The use of Health Care Assistants whose skill level, knowledge and training in resuscitation and drug therapy may be rudimentary are not considered adequate as the main form of assistance for the practitioner or for monitoring the patient.
- *Other assistance:* Extra help should be available to safely move the patient as required.

Fluoroscopy

Bildgebungsverfahren

Understanding the fluoroscopic anatomy of the spine is essential to perform diagnostic and therapeutic spinal interventions safely. It is recommended that fluoroscopy (or ultrasound/CT guidance) be used for spinal interventions.

The correct interpretation of key landmarks in anteroposterior, lateral and oblique views is important for safe fluoroscopic-assisted interventional procedures. A fluorescent table is essential to perform fluoroscopic guided spinal interventions.

A non-ionic water-soluble contrast medium can be injected before injecting any medication at the target point to aid in avoiding incorrect needle position. The contrast medium should be licenced for spinal (including intrathecal) injection. Iodine-containing contrast agents should be used cautiously in patients with altered renal function, and large volumes should not be used on metformin.

Record keeping

Dokumentation

Record-keeping standards should be audited per local clinical governance arrangements.

Records should include the following information: Clinical indication for injection; Date and time of procedure; Type of procedure performed; Name of clinician performing procedure (Printed and signed); Position of patient; Sedation (if used), oxygen, monitoring; Skin preparation; Spinal level of injection; Size of needle (gauge and active tip length); Radio-opaque contrast and dose if used; Any difficulties encountered; Injected drugs and doses; Post-procedure observations; Aftercare instructions; Follow up arrangements; Contact details for patient and primary care team;

Patients should be encouraged to maintain a pain diary at rest and activities of daily living before and after the procedure when diagnostic spinal interventions are performed; Appropriate images should be taken during the procedure to confirm the position of the needle and before and after injection of a radio contrast dye if it is used. According to local hospital guidance, relevant images should be stored in the patient's records or hospital radiology system for clinical and legal purposes.

Follow-up and discharge planning

Nachbeobachtung und Planung einer Entlassung aus dem Spital

On the day of the procedure, patients should be seen by a member of the treating team or a specifically assigned member of staff on admission and prior to discharge. The patient's limbs should be checked for numbness and/or weakness, and should be asked about urine retention or headache. Patients should be ready for discharge one to three hours after the procedure. Usual medication can be resumed on the day of the procedure. If there is unexpected significant limb weakness, sensory loss or headache, an unplanned overnight admission may be necessary, with a review the following day before discharge.

If the procedure is complicated by inadvertent dural puncture, the patient may need a more prolonged admission and management in accordance with local guidance. Facilities for overnight stay should therefore be available.

After discharge, a reliable telephone contact number must be provided so that the patient can report any acute complications such as headache, fever, prolonged numbness/weakness or urinary retention. The day surgery unit, as part of the normal discharge procedure, should provide this.

Other healthcare providers (primary care team, emergency department or daycare staff) who may be involved in the patient's care after the injection should know how to contact a member of the treating team or hospital staff by telephone in order to help make management decisions where necessary.

A letter, with a copy provided to the patient, should be sent to the patient's GP detailing the procedure and follow-up arrangements. The letter should emphasise that fever, severe back pain, or worsening neurological and/or urinary symptoms are potentially serious adverse events and that the patient should be monitored at the primary care level for any such complications.

Emergency full spine MRI scanning should be available. Arrangements should be in place for urgent referrals for neurosurgical or spinal surgical opinions.

3.4 Patients and Social Aspects (SOC)

soziale Aspekte:

Non-systematic literature search and hand search resulted in five references with different study designs relevant to patient and social aspects.

We did not find literature related to patient preferences on interventional procedures for the treatment of chronic spinal pain. Specific issues that need to be communicated to patients are also discussed above within clinical standards [56, 57] [58].

Zugang zu patient:innenzentrierter Versorgung

The Department of Veterans Affairs and the Department of Defense guidelines (VA/DoD CPGs) [59] encourage clinicians to use a patient-centred care approach that is tailored to the patient's capabilities, needs, goals, prior treatment experience, and preferences. All patients in the healthcare system should be offered access to evidence-based interventions appropriate to that patient, regardless of setting. When properly executed, patient-centred care may decrease patient anxiety, increase trust in clinicians, and improve treatment adherence. Improved patient-clinician communication through patient-centred care can be used to convey openness to discuss any future concerns. As part of the patient-centred care approach, clinicians should review the outcomes of past treatment experiences and outcomes of possible future treatments with the patient. Additionally, they should involve the patient in prioritizing and setting specific goals regardless of the selected setting or level of care.

Shared Decision Making (SDM)

Throughout this VA/DoD CPG, the authors encourage clinicians to focus on shared decision-making (SDM). The SDM model was introduced in Crossing the Quality Chasm, an Institute of Medicine (now the National Academy of Medicine) report in 2001 [60]. It is readily apparent that patients with LBP, together with their clinicians, make decisions regarding the type of treatment they choose to engage in; however, these patients require sufficient information to be able to make informed decisions. Clinicians must be adept at presenting information to their patients regarding individual treatment plans and appropriate locations of care.

4 Discussion

Summary and critical reflection on clinical guidelines recommendations

Leitlinienübersicht: 10 Leitlinien

Clinical guidelines are used to translate evidence into practice by synthesizing strong evidence into actionable recommendations [61-64]. In this report, we extracted and summarized the recommendations from ten CGs related to image-guided spinal injections (with local anaesthetic and/or steroids) in the treatment of chronic spinal pain. Seven CGs were related to epidural injections in four indications (axial discogenic pain, disc herniation, spinal stenosis, post-surgery syndrome) and five clinical guidelines on facet joint injections in one indication (axial facet joint pain). The majority of CGs are related to the lumbar spine, which is expected due to the fact that chronic spinal pain is most present in the lower back. Only three CGs on epidural injections and four on facet joint injections provided recommendations on imaging modalities.

To our knowledge, this is the first systematic overview of CGs focusing on treating chronic spinal pain by image-guided spinal injections (with local anaesthetic and/or steroids) in treating chronic spinal pain (specifically epidural injections and facet joint injections).

uneindeutige Empfehlungen in 3 Indikationen und ...

As the overall recommendation for epidural injections is inconsistent in two clinical indications, axial discogenic pain and spinal stenosis, with conflicting recommendations across CGs, physicians who administer epidural injections should consider them very carefully together with their patients to avoid possible overtreatment, adverse effects, and radiation exposure related to fluoroscopy and CT image-guided technologies. The same is true for facet joint injections, for both nerve block and intraarticular injections. Such contradictory recommendations could contribute to the variations observed in clinical practice [34-36] because interventional pain practitioners are challenged on how to appropriately apply such recommendations in their daily practice.

... positive konsistente Empfehlungen in 2 Indikationen

The other two clinical indications for epidural injections, disc herniation and post-surgery syndrome, included both strong and weak recommendations for using epidural injections. Patients require sufficient information to make informed decisions.

keine Leitlienempfehlungen zu bestimmten Bildgebungsverfahren

aber Vorteil niedriger Strahlenbelastung bei Fuoroskopie betont

There is no clear recommendation in CGs for or against fluoroscopy or CT as image-guided technologies, so fluoroscopy may be given preference due to lower radiation exposure for patients. One of the CGs, AWMF S2K 2020 guideline, when reflecting specifically on CT vs. fluoroscopy, pointed out that CT interventions are widespread in German-speaking countries, in contrast to injections under fluoroscopy, and it consequently states the following: If a method is at least equivalent with lower radiation exposure (in this case, fluoroscopy is even superior), then this method (i.e., fluoroscopy) must be given preference over the other method (CT) [26]. Only one low-quality CG mentioned ultrasound for cervical medial branch block.

Qualität der Leitlinien vorwiegend moderat

The overall quality of the CGs ranged from low to high; most were of moderate quality. Only two CGs were of high quality, with scores above the used threshold in this report (>70% for all six domains). These two high-quality CGs were those not recommending the intervention in indications with contradictory recommendations. This could indicate that lower quality guidelines may bias the results in favour of the intervention.

Cochrane 2020: eingeschränkte Evidenz für epidurale Injektionen bei lumbosakralen radikulären Schmerzen

Conclusions from the latest Cochrane review, 2020 [65] related to the use of epidural corticosteroid injections in people with lumbosacral radicular pain are in line with the weak recommendation from one high-quality guideline in indication disc herniation. They concluded that the available evidence still provides only limited support for the use of such intervention, as the treatment effects are small, mainly evident at short-term follow-up and may not be considered clinically important by patients and clinicians (i.e., mean difference lower than 10%). According to GRADE, the quality of this evidence ranged from very low to moderate, suggesting that further studies are likely to play an important role in clarifying the efficacy and tolerability of this treatment.

Summary and critical reflection on other key aspects

Kontextfaktoren wesentlich:

Apart from clinical guidelines recommendations and recommendations on image-guided technologies, we provided information regarding the following two relevant aspects: organisational, specifically important related to the use of image-guided technologies, and patient/social aspects.

organisationale Aspekte wie Verfügbarkeit und

Regarding health care settings and patient/participant flow, shifting spine interventional pain injections from a hospital-based setting to a clinic-based outpatient setting could result in decreased procedural, fluoroscopic, and wait times and a substantial decrease in health system costs.

There are known practice variations regarding the choice of image-guided technologies. Several factors may influence the decision on which image modality to use for nerve root blocks or epidural injections, like the availability of examination slots in the CT unit or fluoroscopy unit, considerations about safety and radiation dose, or preference by the interventionalist or the referring physician.

Strahlenbelastung

As pointed out in the ASIPP clinical guidelines [6], the ALARA (As Low As Reasonably Achievable) principle should be respected when an X-ray is used because excessive radiation to a patient or a physician can cause radiation injury or a stochastic effect such as neoplasm and genetic mutation. Literature data regarding radiation exposure during fluoroscopy-guided pain interventions show that exposure levels are below the yearly limit established by the International Commission on Radiological Protection (ICRP). Exposure to low levels of ionizing radiation over the long term cannot be accurately predicted. Long-term, low-level ionizing radiation exposures may lead to cell damage and genetic mutations that can lead to sequelae years later [66-68].

CT mit höchster Strahlenbelastung

The advantages of CT guidance for spinal interventions, mainly related to more accurate needle tip positioning, were pointed out by different authors. Physicians using CT guidance should have relevant knowledge of relevant CT image acquisition techniques and image interpretation to ensure high rates of technical success. Comprehensive knowledge of appropriate radiation dose reduction strategies is of utmost importance to reduce the dose to the patient, physician and all staff involved. The same is true for spinal injections when guided under fluoroscopy [41-46].

Ultraschall mit keiner Strahlenbelastung, dafür aber schlechtere Sicht

Other image-guided technologies like ultrasound or magnetic resonance imaging (MRI) have been used for needle guidance in spinal injections, but less frequently [9]. Several published articles related to facet joint injections and low-back pain pointed out that facet joint injections can be done under ultrasound guidance with equivalent efficacy to fluoroscopic guidance. However, obese patients may present a challenge for ultrasound guidance due to its poor visualization of deep anatomical structures. Major advantages of ul-

trasound-guided procedures are that ultrasound is radiation-free, low cost, has an excellent quality image for soft tissue and also allows observing vascular tissues, nerves, the contour of bone surfaces, as well as needles and different injectable products during administration, with high-resolution images in real-time. Still, further research is required to understand the exact role of ultrasound in image-guided injections.

Monitoring wesentlich

An important organisational aspect is quality assurance and monitoring. In Europe, standards of good practice for spinal interventional procedures in pain medicine are available and should be followed. Standards are related to environment and facilities, monitoring, assistance, fluoroscopy, record keeping, follow-up, and discharge planning.

Patient:innenpräferenz und informierte Entscheidung

Research is needed on patient preferences for these interventional procedures for the treatment of chronic spinal pain. Specific issues need to be communicated to patients, and a patient-centred care approach that is tailored to the patient's capabilities, needs, goals, prior treatment experience, and preferences should be used. Patients require sufficient information to be able to make informed decisions.

Limitations of the report

Limitationen: 2 Leitlinien mit unzureichender Information zu Suchzeitraum

We excluded guidelines with an outdated literature search. For two CGs related to facet joint injections, one in the cervical spine and one in the lumbar spine, literature search dates were not reported. We judged the risk that these guidelines are outdated not to be substantial, as they were published in 2020 and 2022, respectively and therefore did not exclude them. Despite the fact that the literature search period, as well as the last revision, was taken into account, some guidelines could be based on more recent evidence than others.

Due to the lack of homogeneity in methodology, how CGs formulate the strength of their recommendations and the level of evidence per recommendation, it was difficult to compare and contrast the strength of each recommendation from different guidelines. Because of that, the new classification was created specifically for this review, which has not been previously validated or published.

AGREE-II Tool: unterschiedliche verfügbare Schwellwerte und Einstufung mancher Domäne sensitiv zu Reporting der Leitlinien

The same limitation appears to be present in already published overviews of clinical guidelines using different thresholds used for quality assessment of AGREE II domains [23, 24]. Within the AGREE II appraisal tool [25], there is no clear way to differentiate appraisal scores as a consequence of poor reporting or no reporting. We could have missed some online material important for the quality assessment of different domains. We minimised the risk that a slightly different rating would have impacted the overall results of the guideline synopsis by presenting all guidelines equally.

Although AGREE-II is an established method for assessing the quality of guidelines following stringent criteria, some of domains are still dependent on the judgement of the researcher. In order to minimise bias, a second author was involved and controlled the quality appraisal and a third researcher was involved in case of disagreement.

We did not review the primary studies that informed the CGs. The same was true for resolving conflicting recommendations for the same indications, as this was not the scope of our report.

5 Conclusion

positive konsistente Empfehlungen in 2 Indikationen und

Based on our findings on epidural injections in the treatment of chronic spinal pain for two indications, **disc herniation and post-surgery syndrome**, the synopsis of recommendation pointed to **both strong and weak recommendations for using this intervention**. In the indication of disc herniation, epidural injections guided by fluoroscopy seem to be the most appropriate for the lumbar spine with interlaminar, transforaminal or caudal access mode. Lumbar transforaminal or caudal epidural injections could be considered in patients with post-surgery syndrome.

uneindeutige Empfehlungen in 3 Indikationen

In the **other two indications** of epidural injections (axial discogenic pain and spinal stenosis) as well as concerning **facet joint injections** in axial facet joint pain (nerve block and intraarticular injections), **recommendations** regarding image-guided injections are **contradictory**.

Concerning the spine level, guidelines mostly addressed the lumbar spine and, to a lesser extent, the cervical spine, while the least information is available on the thoracic spine level (no information for the indications of axial discogenic pain, spinal stenosis, or post-surgery syndrome), probably because the spinal pain is rarely present in the thoracic spine.

Routinedatenenalysen für Indikationen mit widersprüchlichen Leitlinienempfehlungen

As a next step indication-specific routine data analysis could be undertaken to evaluate, based on the findings of our report, whether the image guided injections are used adequately or overused in clinical practice. In the latter scenario, **measures** should be implemented to ensure that physicians considering injections in indications with contradictory recommendations or in spine levels with missing recommendations carefully discuss such treatments with their patients **to avoid possible overtreatment, adverse effects, and unnecessary radiation exposure** related to fluoroscopy or CT image-guided technologies. These seem even more important in axial discogenic pain and spinal stenosis, as in the guidelines with the highest quality, recommendations were against using the intervention. Patients generally require sufficient information to make informed decisions.

keine Empfehlung für/gegen spezifische bildgebende Verfahren, aus Sicherheitsgründen eher Fluoroskopie

If CGs stated an imaging technique, all referred to fluoroscopy in epidural injections. For facet joint interventions, fluoroscopic or CT are mentioned. However, no clear recommendations exist for or against a specific imaging technology. **Fluoroscopy may be given preference for safety reasons** due to lower radiation exposure for patients.

Even though **other imaging technologies** such as ultrasound may be attractive (e.g., no radiation exposure, cheaper, requiring less infrastructure and logistics), the guideline which mentioned it for cervical medial branch block is of low quality and further research is needed before considering ultrasound in routine use.

Kontextfaktoren wesentlich

The final choice for imaging technology, in both epidural injections and facet joint injections, also depends on the organisational context and available infrastructure or preference by the interventionalist or the referring physician.

Clinical guidelines are not mandatory nor legally binding. They are living documents and need to be updated, commonly within five years or less, based on significant changes in scientific evidence, public policy, or adverse events. Users of clinical guidelines should be aware of the most recent versions and their quality. Further research is needed regarding patient preferences for these interventional procedures in the treatment of chronic spinal pain.

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Appendix

Level of Evidence (LoE) and Grade of Recommendation (GoR) according the Society group

American Society of Interventional Pain Physicians, ASIPP 2021 [6]

Qualitative modified approach to grading of evidence of therapeutic effectiveness studies (left) and Recommendation grade (right)

Level I	Strong	Evidence obtained from multiple relevant high-quality randomized controlled trials
Level II	Moderate	Evidence obtained from at least one relevant high-quality randomized controlled trial or multiple relevant moderate or low-quality randomized controlled trials
Level III	Fair	Evidence obtained from at least one relevant moderate or low-quality randomized trial or Evidence obtained from at least one relevant high-quality non-randomized trial or observational study with multiple moderate or low-quality observational studies
Level IV	Limited	Evidence obtained from multiple moderate or low-quality relevant observational studies
Level V	Consensus based	Opinion or consensus of large group of clinicians and/or scientists

A	- At least one metaanalysis, systematic review, or RCT rated as 1 + + and directly applicable to the target population or - A systematic review of RCTs or a body of evidence consisting principally of studies rated as 1 + directly applicable to the target population and demonstrating overall consistency of results
B	A body of evidence including studies rated as 2 + + directly applicable to the target population and demonstrating overall consistency of results or - Extrapolated evidence from studies rated as 1 + + or 1 +
C	- A body of evidence including studies rated as 2 + directly applicable to the target population and demonstrating overall consistency of results or - Extrapolated evidence from studies rated as 2 + +
D	- Evidence level 3 or 4 or - Extrapolated evidence from studies rated as 2 +

Guide for strength of recommendations

Rating for Strength of recommendatrion	
Strong	There is high confidence that the recommendation reflects best practice. This is based on: a) strong evidence for a true net effect (e.g., benefits exceed harms); b) consistend results, with no minor exceptions; c) minor or no concerns about study quality; and/or d) the extent the panelists' agreement. Other compelling considerations (discussed in the guideline's literature review and analyses) may also warrant a strong recommendation.
Moderate	There is moderate confidence that the recommendations reflects best practice. This is based on: a) good evidence for a true net effect (e.g. benefits exceed harms); b) consistent results, with minor and/or few exceptions; c) minor and/or few concerns about study quality; and/or d) the extent of panelists' agreement. Other compelling considerations (discussed in the guideline's literature review and analyses) may also warrant a moderate recommendation.
Weak	There is some confidence that the recommendation offers the best current guidance for practice. This is based on: a) limited evidence for a true net effect (e.g., benefits exceed harms); b) consistent results, but with important exceptions; c) concerns about study quality; and/or d) the extent of panelists' agreement. Other considerations (discussed in the guideline's literature review and analyses) may also warrant a weak recommendation.

The American Society of Pain and Neuroscience, ASPN 2022 [14]

Quality of Evidence Ranking Using United States Preventative Services Task Force Criteria Modified for Interventional Spine Procedures

Grade	Definition	Suggestions for practice
A	The ASPN Back Group recommends the service. There is high certainty that the net benefit is substantial.	Offer or provide this service.
B	The ASPN Back Group recommends the service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Offer or provide this service.
C	The ASPN Back Group recommends selectively offering or providing this service to individual patients based on professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small.	Offer or provide this service for selected patients depending on individual circumstances.
D	The ASPN Back Group recommends against the service. There is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Discourage the use of this service.
I Statement	The ASPN Back Group concludes that the current evidence is insufficient to assess the balance of benefits and harms of the service. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	Read the clinical considerations section of USPSTF Recommendation Statement. If the service is offered, patients should understand the uncertainty about the balance of benefits and harms.

Abbreviation: ASPN, American Society of Pain and Neuroscience.

Levels of Certainty Regarding Net Benefit

Level of certainty	Description
High	The available evidence includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects of the preventive service on health outcomes. This conclusion is therefore unlikely to be strongly affected by the results of future studies. **Evidence Level: I-A** - At least one controlled and randomized clinical trial, properly designed
Moderate	The available evidence is sufficient to determine the effects of the preventive service on health outcomes, but confidence in the estimate is constrained by such factors as: • The number, size, or quality of individual studies. • Inconsistency of findings across individual studies. • Limited generalizability of findings to routine primary care practice. • Lack of coherence in the chain of evidence. • As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion. **Evidence Level I-B** - Well-designed, controlled, non-randomized clinical trials (Prospective Observational studies conforming to STROBE criteria) or **Evidence Level I-C** - Retrospective cohort or large case studies (>20 subjects)
Low	The available evidence is insufficient to assess effects on health outcomes. Evidence is insufficient because of: • The limited number or size of studies. • Important flaws in study design or methods. • Inconsistency of findings across individual studies. • Gaps in the chain of evidence. • Findings not generalizable to routine primary care practice. • Lack of information on important health outcome **Evidence Level II** - Expert opinion based of risk-to-benefit or based upon case reports

Abbreviation: STROBE, Strengthening the Reporting of Observational Studies in Epidemiology.

American Society of Pain and Neuroscience, ASPN 2022 [27]

Quality of Evidence Ranking Using United States Preventative Services Task Force Criteria Modified for Therapy

Grade	Definition	Suggestions for Practice
A	ASPN MIST consensus committee recommends the service. There is high certainty that the net benefit is substantial.	Offer or provide this service.
B	ASPN MIST consensus committee recommends the service. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Offer or provide this service.
C	ASPN MIST consensus committee recommends selectively offering or providing this service to individual patients based on professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small.	Offer or provide this service for selected patients depending on individual circumstances.
D	ASPN MIST consensus committee recommends against the service. There is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Discourage the use of this service.
I (Insufficient) Statement	ASPN MIST consensus committee concludes that the current evidence is insufficient to assess the balance of benefits and harms of the service. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	Read the clinical considerations section of USPSTF Recommendation Statement. If the service is offered, patients should understand the uncertainty about the balance of benefits and harms.

Levels of Certainty Regarding Net Benefit

Level of Certainty	Description
High	The available evidence includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects of the preventive service on health outcomes. This conclusion is therefore unlikely to be strongly affected by the results of future studies. **Evidence Level: I-A** – At least one controlled and randomized clinical trial, properly designed
Moderate	The available evidence is sufficient to determine the effects of the preventive service on health outcomes, but confidence in the estimate is constrained by such factors as: ● The number, size, or quality of individual studies. ● Inconsistency of findings across individual studies. ● Limited generalizability of findings to routine primary care practice. ● Lack of coherence in the chain of evidence. As more information becomes available, the magnitude or direction of the observed effect could change, and this change may be large enough to alter the conclusion. **Evidence Level I-B** – Well-designed, controlled, non-randomized clinical trials (Prospective Observational studies conforming to STROBE criteria) or **Evidence Level I-C** – Retrospective cohort or large case studies (>20 subjects)
Low	The available evidence is insufficient to assess effects on health outcomes. Evidence is insufficient because of: ● The limited number or size of studies. ● Important flaws in study design or methods. ● Inconsistency of findings across individual studies. ● Gaps in the chain of evidence. ● Findings not generalizable to routine primary care practice. ● Lack of information on important health outcome **Evidence Level II** – Expert opinion based on risk:benefit or based upon case reports

American Society of Interventional Pain Physicians, ASIPP 2020 [12]

Qualitative modified approach to grading of evidence of diagnostic accuracy and therapeutic effectiveness studies

Level I	Strong	Evidence obtained from multiple relevant high quality randomized controlled trials or Evidence obtained from multiple high quality diagnostic accuracy studies
Level II	Moderate	Evidence obtained from at least one relevant high quality randomized controlled trial or multiple relevant moderate or low quality randomized controlled trials or Evidence obtained from at least one high quality diagnostic accuracy study or multiple moderate or low quality diagnostic accuracy studies
Level III	Fair	Evidence obtained from at least one relevant moderate or low quality randomized controlled trial study or Evidence obtained from at least one relevant high quality non-randomized trial or observational study with multiple moderate or low quality observational studies or Evidence obtained from at least one moderate quality diagnostic accuracy study in addition to low quality studies
Level IV	Limited	Evidence obtained from multiple moderate or low quality relevant observational studies or Evidence obtained from multiple relevant low quality diagnostic accuracy studies
Level V	Consensus based	Opinion or consensus of large group of clinicians and/or scientists

Guide for strength of recommendations

Rating for Strength of recommendation	
Strong	There is high confidence that the recommendation reflects best practice. This is based on: a) strong evidence for a true net effect (e.g., benefits exceed harms); b) consistent results, with no or minor exceptions; c) minor or no concerns about study quality; and/or d) the extent the panelists' agreement. Other compelling considerations (discussed in the guideline's literature review and analyses) may also warrant a strong recommendation.
Moderate	There is moderate confidence that the recommendation reflects best practice. This is based on: a) good evidence for a true net effect (e.g. benefits exceed harms); b) consistent results, with minor and/or few exceptions; c) minor and/or few concerns about study quality; and/or d) the extent of panelists' agreement. Other compelling considerations (discussed in the guideline's literature review and analyses) may also warrant a moderate recommendation.
Weak	There is some confidence that the recommendation offers the best current guidance for practice. This is based on: a) limited evidence for a true net effect (e.g., benefits exceed harms); b) consistent results, but with important exceptions; c) concerns about study quality; and/or d) the extent of panelists' agreement. Other considerations (discussed in the guideline's literature review and analyses) may also warrant a weak recommendation.

US Association for the Study of Pain, USASP 2021 [28]

Significance of the Four Levels of Evidence According to Grades of Recommendation, Assessment, Development, and Evaluation (GRADE)

Quality of evidence	*Definition*
High (⊕⊕⊕⊕)	We are very confident that the true effect lies close to the estimate of the effect.
Moderate (⊕⊕⊕O)	We are moderately confident of the estimated effect: The true effect is likely to be close to the estimate, but there is a possibility that it is substantially different.
Low (⊕⊕OO)	We have limited confidence of estimated effect: The true effect may be substantially different from the estimated effect.
Very low (⊕OOO)	We have very little confidence in the estimated effect: The true effect is likely to be substantially different from the estimate.

The **strength rating of a recommendation (strong, weak/conditional)** was defined as the extent to which the desirable consequences of an intervention outweigh its undesirable consequences. A **strong recommendation** can be made when the desirable consequences clearly outweigh the undesirable consequences. In contrast, a **conditional or weak** recommendation is made when the desirable consequences likely outweigh the undesirable consequences. If the evidence was not compelling, the decision to write or not write a recommendation was based on **consensus** of the panel.

North American Spine Society, NASS 2020 [29]

Levels of Evidence for Primary Research Question

	Types of Studies			
	Therapeutic Studies Investigating the results of treatment	**Prognostic Studies** Investigating the effect of a patient characteristic on the outcome of disease	**Diagnostic Studies** Investigating a diagnostic test	**Economic and Decision Analyses** Developing an economic or decision model
Level I	• High quality randomized trial with statistically significant difference or no statistically significant difference but narrow confidence intervals • Systematic review[2] of Level I RCTs (and study results were homogenous[3])	• High quality prospective study[4] (all patients were enrolled at the same point in their disease with ≥ 80% follow-up of enrolled patients) • Systematic review[2] of Level I studies	• Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference "gold" standard) • Systematic review[2] of Level I studies	• Sensible costs and alternatives; values obtained from many studies; with multiway sensitivity analyses • Systematic review[2] of Level I studies
Level II	• Lesser quality RCT (eg, < 80% follow-up, no blinding, or improper randomization) • Prospective[4] comparative study[5] • Systematic review[2] of Level II studies or Level I studies with inconsistent results	• Retrospective[6] study • Untreated controls from an RCT • Lesser quality prospective study (eg, patients enrolled at different points in their disease or <80% follow-up) • Systematic review[2] of Level II studies	• Development of diagnostic criteria on consecutive patients (with universally applied reference "gold" standard) • Systematic review[2] of Level II studies	• Sensible costs and alternatives; values obtained from limited studies; with multiway sensitivity analyses • Systematic review[2] of Level II studies
Level III	• Case-control study[7] • Retrospective[6] comparative study[5] • Systematic review[2] of Level III studies	Case-control study[7]	• Study of non-consecutive patients; without consistently applied reference "gold" standard • Systematic review[2] of Level III studies	• Analyses based on limited alternatives and costs; and poor estimates • Systematic review[2] of Level III studies
Level IV	Case series[8]	Case series[8]	• Case-control study[7] • Poor reference standard	Analyses with no sensitivity analyses
Level V	Expert opinion	Expert opinion	Expert opinion	Expert opinion

1. A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.
2. A combination of results from two or more prior studies.
3. Studies provided consistent results.
4. Study was started before the first patient enrolled.
5. Patients treated one way (eg, cemented hip arthroplasty) compared with a group of patients treated in another way (eg, uncemented hip arthroplasty) at the same institution.
6. The study was started after the first patient enrolled.
7. Patients identified for the study based on their outcome, called "cases"; eg, failed total arthroplasty, are compared to those who did not have outcome, called "controls"; eg, successful total hip arthroplasty.
8. Patients treated one way with no comparison group of patients treated in another way.

Grades of Recommendation for Summaries or Reviews of Studies

A: Good evidence (Level I studies with consistent findings) for or against recommending intervention.

B: Fair evidence (Level II or III studies with consistent findings) for or against recommending intervention.

C: Poor quality evidence (Level IV or V studies) for or against recommending intervention.

I: There is insufficient or conflicting evidence not allowing a recommendation for or against intervention.

Linking Levels of Evidence to Grades of Recommendation

Grade of Recommendation	Standard Language	Levels of Evidence	
A	Recommended	Two or more consistent Level I studies	
B	Suggested	One Level I study with additional supporting Level II or III studies	Two ore more consistent level II or III studies
C	May be considered; is an option	One Level I, II, III or IV study with supporting Level IV studies	Two or more consistent Level IV studies
I	Insufficient evidence to make recommendation for or against	A single level I, II, III or IV study without other supporting evidence	More than one study with inconsistent findings*

* Note that in the presence of multiple consistent studies and a single outlying, inconsistent study, the Grade of Recommendation will be based on the level of the consistent studies.

German Society for Orthopedics and Orthopedic Surgery (DGOOC),
Spine Section of the German Society for Orthopedics and Trauma Surgery (DGOU),
German Society for Neurosurgery (DGNC) and German Spine Society (DWG), AWMF 2020 [26]

- Can be used: the group of experts recommends the procedure as a therapy option.
- Should (not) be used: the group of experts (does not) recommend the procedure as the method of second choice.
- Ought (not) be used: the group of experts (not) recommends the procedure as the method of first choice.

International working group (Lumbar Facet Intervention Guidelines Committee), 2020 [30]
International working group (Cervical Joint Working Group), 2022 [31]

Levels of evidence for guidelines and recommendations

Certainty of net benefit	Magnitude of net benefit			
	Substantial	Moderate	Small	Zero/Negative
High	A	B	C	D
Moderate	B	B	C	D
Low	Insufficient			

What the grades of evidence mean and suggestions for practice

Grade	Definition	Suggestions for practice
A	Our committee recommends this treatment, test or strategy to improve outcomes. There is high certainty that the net benefit is substantial.	Offer or provide this service.
B	Our committee recommends this treatment, test or strategy to improve outcomes. There is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial.	Offer or provide this service.
C	Our committee recommends selectively offering or providing this treatment, test or strategy to improve outcomes to individual patients based on professional judgment and patient preferences. There is at least moderate certainty that the net benefit is small.	Offer or provide this service for selected patients depending on individual circumstances.
D	Our committee recommends against the intervention. There is moderate or high certainty that the service has no net benefit or that the harms outweigh the benefits.	Discourage the use of this service.
I Statement	Our committee concludes that the current evidence is insufficient to assess the balance of benefits and harms of the intervention. Evidence is lacking, of poor quality, or conflicting, and the balance of benefits and harms cannot be determined.	Read the clinical considerations section of the Recommendation Statement. If the treatment or service is offered, patients should understand the uncertainty about the balance of benefits and harms.

Levels of certainty regarding net benefit

Level of certainty	Description
High	The available evidence usually includes consistent results from well-designed, well-conducted studies in representative populations with suspected lumbar facetogenic pain. The studies assess the effects of the treatment, test or other intervention on treatment or other relevant outcomes. The conclusion is therefore unlikely to be strongly affected by the results of future studies.
Moderate	The available evidence is sufficient to determine the effects of the intervention on outcomes, but confidence in the estimate is constrained by such factors as: ► The number, size, or quality of individual studies; ► Inconsistency of findings across individual studies; ► Limited generalizability of findings to individuals with suspected lumbar facetogenic pain; ► High likelihood of bias; ► Lack of coherence in the chain of evidence. As more information becomes available, the magnitude or direction of the observed effect could change, and that change may be large enough to alter the conclusion.
Low	The available evidence is insufficient to assess effects on treatment and other outcomes of interest. Evidence is insufficient because of: ► The limited number or size of studies; ► Important flaws in study design or methods; ► Inconsistency of findings across individual studies; ► Gaps in the chain of evidence; ► High likelihood of bias; ► Findings not generalizable to individuals with suspected lumbar facetogenic pain; ► Lack of information on important outcome measures. More information may allow estimation of effects on treatment outcomes.

Quality of the eligible guidelines according to Appraisal of Guidelines Research & Evaluation (AGREE) II Instrument

Table A-1: Appraisal of Guidelines Research & Evaluation (AGREE) II domain scores and quality of the eligible guidelines (n=10)

Guideline	Scope and Purpose, %	Stakeholder Involvement, %	Rigor of Development, %	Clarity of Presentation, %	Applicability, %	Editorial Independence, %	Quality (High, Moderate, Low)
ASIPP, 2021 [6]	100	66.7	91	90.5	14.3	100	**Moderate**
AWMF, 2020 [26]	95.2	71.4	48.2	90.5	14.3	93	**Moderate**
ASPN, 2022 [14]	95.2	71.4	78.6	100	14.3	57.1	**Moderate**
ASPN, 2022 [27]	95.2	52.4	75	81	25	57.1	**Low**
USASP, 2021 [28]	100	71.4	100	95.2	100	100	**High**
NASS, 2020 [29]	100	100	100	100	14.3	100	**Moderate**
NICE, 2020 [15]	100	100	100	100	100	100	**High**
ASIPP, 2020 [12]	100	71.4	91.1	100	14.3	100	**Moderate**
IWG (Lumbar facet), 2020 [30]	95.2	71.4	69.6	100	14.3	100	**Moderate**
IWG (Cervical Joint), 2022 [31]	90.5	66.7	67.9	100	14.3	100	**Low**

Abbreviations: AGREE: Appraisal of Guidelines Research & Evaluation; ASIPP: American Society of Interventional Pain Physicians; AWMF: German Society for Orthopedics and Orthopedic Surgery (DGOOC), Spine Section of the German Society for Orthopedics and Trauma Surgery (DGOU), German Society for Neurosurgery (DGNC) and German Spine Society (DWG); ASPN: American Society of Pain and Neuroscience; USASP: US Association for the Study of Pain; NASS: North American Spine Society; IWG (Lumbar Facet): International working group (Lumbar Facet Intervention Guidelines Committee); IWG (Cervical Joint): International working group (Cervical Joint Working Group)

Literature Search strategy

Search strategy for Embase

Search Name: Spinal injections for chronic back pain		
Search date: 02.06.2023		
No.	Query Results	Results
#28.	#26 NOT #27	819
#27.	#26 AND 'Conference Abstract'/it	309
#26.	#24 AND [2018-2023]/py AND ([english]/lim OR [german]/lim)	1,128
#25.	#24 AND [2018-2023]/py	1,149
#24.	#20 NOT #23	5,295
#23.	#21 OR #22	2,605,193
#22.	'animal experiment'/de NOT ('human experiment'/de OR 'human'/de)	2,538,840
#21.	(rat:ti,tt OR rats:ti,tt OR mouse:ti,tt OR mice:ti,tt OR swine:ti,tt OR porcine:ti,tt OR murine:ti,tt OR sheep:ti,tt OR lambs:ti,tt OR pigs:ti,tt OR piglets:ti,tt OR rabbit:ti,tt OR rabbits:ti,tt OR cat:ti,tt OR cats:ti,tt OR dog:ti,tt OR dogs:ti,tt OR cattle:ti,tt OR bovine:ti,tt OR monkey:ti,tt OR monkeys:ti,tt OR trout:ti,tt OR marmoset*:ti,tt) AND 'animal experiment'/de	1,208,926
#20.	#16 AND #19	5,521
#19.	#17 OR #18	37,017
#18.	(spin* OR epidural OR extradural OR peridural OR transforaminal OR interlaminar OR caudal OR 'nerve root*' OR 'facet joint*') NEAR/2 (inject* OR infiltrat*)	9,979
#17.	'intraspinal drug administration'/exp	29,675
#16.	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15	371,109
#15.	(low* OR spin* OR disk* OR disc* OR neck OR cervi* OR thora* OR sacral OR iliosacr* OR 'ilio sacr*' OR sacroili* OR 'sacro ili*' OR lumb* OR cocc* OR sacrococc* OR 'sacro cocc*' OR sciatic OR facet*) NEAR/2 (pain* OR ache* OR syndrome*)	317,863
#14.	'failed back surgery syndrome'/exp/mj	810
#13.	coccygodynia*	412
#12.	'coccygodynia'/exp	185
#11.	coccydynia*	275
#10.	'coccydynia'/exp	55
#9.	sciatic*	48,285
#8.	'sciatica'/exp/mj	808
#7.	'neck pain'/exp/mj	6,501
#6.	'lumbo ischialgia*'	15
#5.	lumboischialgia*	96
#4.	'ischialgia'/exp/mj	3,523
#3.	lumbago*	2,156
#2.	'backache'/exp/mj	43,602
#1.	'chronic back pain'/exp	55

Search strategy for Medline via Ovid

Search Name: Spinal injections for chronic back pain	
Search date: 01.06.2023	
ID	Search
1	exp Back Pain/ (44737)
2	lumbago*.mp. (1528)
3	lumboischialgia*.mp. (55)
4	lumbo-ischialgia*.mp. (16)
5	exp Neck Pain/ (8461)
6	exp Sciatica/ (5195)
7	sciatic*.mp. (40525)
8	coccydynia*.mp. (190)
9	coccygodynia*.mp. (256)
10	exp Failed Back Surgery Syndrome/ (467)
11	((low* or spin* or disk* or disc* or neck or cervi* or thora* or sacral or iliosacr* or ilio-sacr* or sacroili* or sacro-ili* or lumb* or cocc* or sacrococc* or sacro-cocc* or sciatic or facet*) adj3 (pain* or ache* or syndrome*)).mp. (147045)
12	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 (196328)
13	exp Injections, Spinal/ (17244)
14	((spin* or epidural or extradural or peridural or transforaminal or interlaminar or caudal or nerve root* or facet joint*) adj3 (inject* or infiltrat*)).mp. (23054)
15	13 or 14 (23989)
16	12 and 15 (3942)
17	exp animals/ not humans.sh. (5125447)
18	16 not 17 (3297)
19	limit 18 to yr="2018 - 2023" (806)
20	limit 19 to (english or german) (798)
21	remove duplicates from 20 (795)

Search strategy for Cochrane

Search Name: Spinal injections for chronic back pain	
Search date: 05.06.2023	
Comment: MH/GG	
ID	Search
#1	MeSH descriptor: [Back Pain] explode all trees
#2	(lumbago*) (Word variations have been searched)
#3	(lumboischialgia*) (Word variations have been searched)
#4	(lumbo-ischialgia*) (Word variations have been searched)
#5	MeSH descriptor: [Neck Pain] explode all trees
#6	MeSH descriptor: [Sciatica] explode all trees
#7	(sciatic*) (Word variations have been searched)
#8	(coccydynia*) (Word variations have been searched)
#9	(coccygodynia*) (Word variations have been searched)
#10	MeSH descriptor: [Failed Back Surgery Syndrome] explode all trees
#11	((low* OR spin* OR disk* OR disc* OR neck OR cervi* OR thora* OR sacral OR iliosacr* OR ilio-sacr* OR sacroili* OR sacro-ili* OR lumb* OR cocc* OR sacrococc* OR sacro-cocc* OR sciatic OR facet*) NEAR (pain* OR ache* OR syndrome*)) (Word variations have been searched)
#12	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11
#13	MeSH descriptor: [Injections, Spinal] explode all trees

#14	((spin* OR epidural OR extradural OR peridural OR transforaminal OR interlaminar OR caudal OR nerve root* OR facet joint*) NEAR (inject* OR infiltrat*)) (Word variations have been searched)
#15	#13 OR #14
#16	#12 AND #15 with Cochrane Library publication date Between Jan 2018 and Jun 2023
#17	#12 AND #15 with Publication Year from 2018 to 2023, in Trials
#18	#16 OR #17
#19	(conference proceeding):pt
#20	(abstract):so
#21	(clinicaltrials OR trialsearch OR ANZCTR OR ensaiosclinicos OR Actrn OR chictr OR cris OR ctri OR registroclinico OR clinicaltrialsregister OR DRKS OR IRCT OR Isrctn OR rctportal OR JapicCTI OR JMACCT OR jRCT OR JPRN OR Nct OR UMIN OR trialregister OR PACTR OR R.B.R.OR REPEC OR SLCTR OR Tcr):so
#22	#19 OR #20 OR #21
#23	#18 NOT #22
Total hits: 585	

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Health Technology Assessment
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